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The extension of the scope of the National Museum during recent years and the activity of the collectors employed in its interest have caused a great increase in the amount of material in its possession. Many of the objects gathered are of a novel and important character, and serve to throw a new light upon the study of nature and of man.

The importance to science of prompt publication of descriptions of this material led to the establishment, in 1878, of the present series of publications, entitled "Proceedings of the United States National Museum," the distinguishing peculiarity of which is that the articles are published in pamphlet form as fast as completed and in advance of the bound volume. The present volume constitutes the nineteenth of the series.

The articles in this series consist: First, of papers prepared by the scientific corps of the National Museum; secondly, of papers by others, founded upon the collections in the National Museum; and, finally, of facts and memoranda from the correspondence of the Smithsonian Institution.

The Bulletin of the National Museum, the publication of which was commenced in 1875, consists of elaborate papers based upon the collections of the Museum, reports of expeditions, etc., while the Proceedings facilitate the prompt publication of freshly acquired facts relating to biology, anthropology, and geology, descriptions of restricted groups of animals and plants, the discussion of particular questions relative to the synonymy of species, and the diaries of minor expeditions.

Other papers of more general popular interest are printed in the Appendix to the Annual Report.

Papers intended for publication in the Proceedings and Bulletin of the National Museum are referred to the Advisory Committee on Publications, composed as follows: Frederick W. True (chairman), Marcus Benjamin (editor), James E. Benedict, Otis T. Mason, Leonhard Stejneger, and Lester F. Ward.

S. P. LANGLEY,
Secretary of the Smithsonian Institution.

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A REVISION OF THE AMERICAN MOLES.

By FREDERICK W TRUE,
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THE EXISTENCE of moles in North America was known to naturalists at least as early as the middle of the eighteenth century. Under date of October 12, 1748, Kalm mentions seeing burrows of a mole on the banks of the Schuylkill River at Philadelphia. He remarks on the characteristics of an individual kept in captivity, but it is not clear from his account at what time it came under his observation, though probably not long after the date cited above.[1]

The first explicit mention of specimens which I find is that of Barrington in the Philosophical Transactions in 1772.[2]

Barrington wrote to the secretary of the Royal Society of London, under date of May 15, 1771, as follows:

> I send herewith a mole from North America, which Mr. Kuckahn (who hath before presented several birds and insects to the Society) desires they will do him the honour to place in their Museum.

From the description which follows, it appears probable that the specimen (which included part of the skull) was our common mole, *Scalops aquaticus*.

There is a reference to specimens of almost the same date in Boddaert's translation of Linnæus's Systema Naturæ in 1772.[3] In a footnote, under the heading of *Sorex cristatus*, he remarks:

> This very rare species makes a connection between the mole and shrew. It is more like a mole than a shrew. I have seen the same in the celebrated cabinet of Mr. Van der Meulen in Amsterdam.

Linnæus may have found specimens of American moles in the Swedish museums to which he had access, though it is improbable; if not, he must have received correct descriptions or specimens from Kalm, who traveled in America for him and was in correspondence with him. Linnæus diagnoses the species correctly, which he could

[1] Kalm's Travels, Forster's English Trans., I, 1770, p. 190. The species was probably *Scalops aquaticus*, but Forster believed that it was *Condylura*.

[2] Account of a Mole from North America: In a letter to Dr. Maty, Sec. R. S., from the Hon. Daines Barrington, F. R. S., Phil. Trans., LXI, pt. 1, p. 292.

[3] Boddaert, Linn. Nat., I, 1772, p. 51.

not have done from the statements of Seba, who, if my view is correct, did not have any American specimens of moles, though he describes some as such.[1]

The records mentioned thus far relate to *Scalops aquaticus* or *Condylura cristata*, but William Bartram (born in 1739, died in 1823) seems to have known at an early date of the existence of the species now called Brewer's mole, *Parascalops breweri*. There is a reference to his manuscript name, "*Talpa americana*, black mole" (but no description), in Harlan's Fauna Americana of 1825.[2] There were specimens of Brewer's mole in London prior to 1829, but they were not recognized as such, and the species was not formally described until 1842, when Bachman published a notice of it.

The Pacific Coast mole, *Scapanus townsendi*, came under the observation of Lewis and Clarke between 1804 to 1806, but they did not recognize the fact that it was different from the species of the Atlantic Coast.[3] This was reserved for Bachman in 1839. There were specimens in the museum of the Hudson's Bay Company, however, prior to 1829.

The very remarkable little mole of the Pacific Coast, *Neürotrichus gibbsii*, remained unknown to science until 1857, when it was described by Professor Baird from a specimen collected in 1854 by George Gibbs.

Many zoologists, beginning with Linnæus, were disposed to regard the American moles as shrews. Linnæus placed both the common Eastern mole and the Star-nosed mole in his genus *Sorex*, which is practically equivalent to the family *Soricidæ* of the present day. This view was opposed by Pennant as early as 1771, who places the American forms known to him with the moles.[4]

Most unfortunately, however, he classifies his "Yellow Mole," which he got from New York, and was really *Scalops aquaticus*, as a variety of the European mole. The consequence was that the impression prevailed, even as late as 1829, that a variety of the European mole (i. e., a representative of the genus *Talpa*) existed in America.[5] The truth was obscured also from the fact that there were specimens in London at a comparatively early date of Brewer's mole, which in color resembles the European mole. After 1831, when Godman expressed disbelief in the occurrence of *Talpa* in America, that generic name as applied to

[1] As will appear later, Seba's "*Talpa, rubra, Americana*" (supposed to be from the West Indies), represented in his plate 32, is probably a *Chrysochloris;* while his *Talpa, Virginianus, niger*, supposed to be from Virginia, is an European mole. (SEBA, Thesaurus, I, pl. 32.)

[2] Page 43.

[3] See COUES's Lewis and Clarke's Expedition, 1804–1806, III, 1893, p. 864.

[4] Synopsis of Quadrupeds, 1771, p. 315 (*fide* Fischer). I have not seen this work. In the 3d edition (History of Quadrupeds), II, 1793, p. 233, he remarks: "Linnæus places this [i. e., *Scalops aquaticus*] and our radiated mole in his class of Sorex, or shrew, on account of the difference of the teeth; but as these animals possess the stronger characters of the mole, such as form of nose and body, shape of feet, and even the manner, we think them better adapted to this genus than to the preceding."

[5] See Richardson, Fauna Bor. Amer., Quad., I, 1829, p. 12.

American forms seems to have finally disappeared from the literature.[1]

The history of the classification of the *Insectivora* has been ably expounded by Dr. Gill,[2] and it is unnecessary for me in this connection to treat of it in detail. I shall content myself with running over the principal phases of the matter as relates to the *Talpidæ*, beginning at a somewhat earlier date than Dr. Gill has done, and including some systems which he has omitted.

In Linnæus' time and for a half century afterwards the genera of animals were grouped together in orders without intermediate segregation as families. The genera were, however, in many cases practically equivalent in value to family divisions as employed at the present day. In 1813 Fischer proposed a classification of mammals, based on the structure of the feet, into which family divisions as now used were introduced. He divides mammals into *Quadrupeda* and *Cetacea* (or *Apoda*), and the former again into *Fissipeda* and *Plectopoda*. The *Fissipeda* are again divided into *Unguiculata* and *Ungulata*. The *Unguiculata* comprises five orders, one of which, the *Plantigrada*, includes four families, namely: *Erinacini*, *Soricini*, *Talpini*, and *Ursini*. The family *Talpini* contains three genera, namely: *Talpa*, *Scalops*, and *Chrysochloris*. The species are as follows: *Talpa europæa*, *Scalops cristatus* (=*Condylura cristata*), *Chrysochloris capensis*.

Our star-nosed mole, in this system, belongs to the order *Plantigrada*, family *Talpini*, and genus *Scalops*. The system as a whole is of little merit, considering that the bears are placed in the same order with the moles, while the musk shrew, *Mygale*, on account of its webbed feet, is placed in an entirely different division of the class.

In 1821 we find the American moles placed with others by Dr. Gray[3] in a family called *Mygalada*,[4] with the following genera: *Mygale*,[4] *Scalops*, *Condylura*, *Chrysochloris*.

The construction of this family is somewhat more satisfactory than that of Fischer, in that *Mygale* is included; but the inclusion of *Chrysochloris* and the singular omission of *Talpa* are serious defects.[5]

In 1825, and for nearly twenty years afterwards, Dr. Gray employed a system which, so far as the family in which we are interested is concerned, was distinctly inferior to the earlier one.[6] He united all the

[1] It is true that it occurs in De Blainville's Osteographie, published between 1839 and 1861, but as he employs the name *Scalops* as a subgeneric term the case is hardly one in point. I should mention, however, that two specimens from North America are marked *Talpa europæa* with a query in Waterhouse's catalogue of the mammalia in the museum of the Zoological Society of London, published in 1838 (p. 16).

[2] Synopsis of Insectivorous Mammals. Bull. U. S. Geog. and Geol. Survey of the Territories, No. 2, 2 ser., 1875, p. 91.

[3] On the natural arrangement of vertebrose animals. London Medical Repository, XV, 1821, pp. 296–310.

[4] In these names the letter g is omitted in the original, but this is evidently a typographical error, of which there are many in the article.

[5] No notice is taken here of the more general features of this classification. For these, reference should be made to Dr. Gill's Synopsis.

[6] Annals of Philosophy, XXVI (new series X), 1825, p. 337.

insectivorous mammals then known in the single family *Talpidæ*. It might be supposed that this was merely a case of employing the term family in the sense of order, but such is not the truth, as appears from the fact that the *Talpidæ* with other families was included in the order *Feræ*.

The system proposed by Bonaparte in 1831 does not differ essentially so far as the family *Talpidæ* is concerned from that of Fischer and the earlier one of Gray, but the genus *Talpa* is restored to its proper place. His section *Talpina* of the family *Talpidæ* comprises the genera *Talpa*, *Condylura*, *Chrysochloris*, *Scalops*.[1] A remarkable feature of his classification is that the family *Talpidæ* (which he also styles *Insectivora*, a name now used for the order) is placed under the order *Chiroptera*.

Pomel's system proposed in 1848 has no merit so far as the moles as a whole are concerned, as he brings them into one group, called the family *Spalacogalæ*, with the shrews and such other genera as *Chrysochloris* and *Solenodon*.[2]

The divisions which he makes in his tribe (or subfamily) *Talpina*, however, leaving out of consideration the fossil forms and the remote genera mentioned above, are nearly such as are now current. With the eliminations mentioned, we have the following:

First tribe—Talpina.
  First type—[Pachyrhiniens.]
    Talpa.
    Mogera.
    Astromycter [=Condylura.]
  Second type—[Leptorhiniens.]
    Scalops.
    Scapanus.
Second tribe—Mygalina.
  First type—[Amblysomiens.]
  Second type—[Macruriens.]
    Mygale.
  Third type—[Unnamed].
    Urotrichus.[3]

Gervais's system, published in his Natural History of Mammals in 1854, is hardly more satisfactory, as he classifies *Urotrichus* and *Mygale* with the shrews, and leaves *Chrysochloris* among the moles.[4] His arrangement is as follows:

Famille des Talpidés.
  Tribu des Chrysochlores.
    Genre Chrysochlore (Chrysochloris).
  Tribu des Scalopes.
    Genre Scalope (Scalops).

[1] Bonaparte, Saggio Dist. Metod. Ann. Vert., 1831, p. 16.

[2] Archiv. Sci. Phys. et Nat., IX, 1848, pp. 244–252.

[3] Dr. Gill, in his abstract of the system, has added the words "Japan, California," to the name of this genus, from which it might be inferred that Pomel knew of the occurrence of an *Urotrichus*-like mole in California at this early date (1848). This is not really the case, however. In Bull. Geol. Soc. France, 2 ser., VI, 1848, p. 58, Pomel remarks "Le genre *Urotrichus* ne sort pas du Japon."

[4] Histoire naturelle des mammifères, I, 1854–55, p. 250.

Famille des Talpidés—Continued.
Tribu des Condylures.
Genre Condylure (Condylura).
Tribu des Taupes.
Genre Taupe (Talpa).

Though in French form, the names of the tribes correspond more closely to those now in use than do Pomel's. Like Pomel, he has separated *Chrysochloris* under a distinct tribal name, which was a step toward its final elimination from the family *Talpidæ*.

In the supplement to Schreber's *Säugethiere*, by J. A. Wagner, published in 1855, the classification is simple in that the genera of moles are brought together under a family designation (*Talpina*), without intermediate divisions. His arrangement is defective in that he includes *Chrysochloris* in the family and places *Mygale* with the shrews. Peters employed the same form for the family in 1864, but included *Mygale*.[1]

In these two instances there is no special improvement, so far as this family is concerned, over Gray's classification of 1821.

It was reserved for Dr. Mivart, in 1867, to finally remove *Chrysochloris* to a distinct family established for its reception. The moles were then classified as follows:

Family Talpidæ.
Subfamily Talpina.
Scalops.
Scapanus.
Condylura.
Talpa.
Subfamily Myogalina.
Urotrichus.
Myogale.[2]

We come finally to Dr. Gill, who accepted Mivart's arrangement of the family, but elaborated it by dividing the two subfamilies into sections, as follows:

Family Talpidæ.
Subfamily Talpinæ.
(Talpæ).
Talpa.
Mogera.
Parascaptor.
Scaptochirus.
Scaptonyx.
(Condyluræ).
Condylura.
(Scalopes).
Scalops.
Scapanus.
Subfamily Mygalinæ.
(Mygalæ).
Desman (=Mygale).
(Urotrichi).
Urotrichus.
Uropsilus.[3]

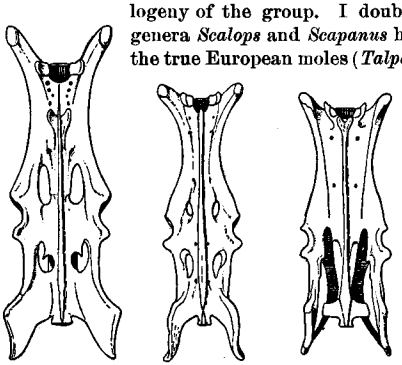
[1] Monatsberichte Akad. Wissensch. Berlin, 1865, p. 286.
[2] Journ. Anat. & Physiol., 1, 1867, p. 281.
[3] Bull. Geol. and Geog. Survey of the Territories, No. 2, 2 ser., 1875, p. 110.

The last reviewer of the group, the late Dr. Dobson, adopts Dr. Gill's arrangement, only adding the genus *Scaptonyx* and placing *Uropsilus* in a separate section (*Uropsili*).[1] It is to be observed, however, that he does not formally divide the family into the two subfamilies *Mygalinæ* and *Talpinæ*, since he does not regard the characters on which these distinctions are founded as sufficiently trenchant. In this I agree with him, though for convenience I have employed the divisions in the key on p. 7.

The aberrant genus *Condylura*, though placed with the typical moles in the subfamily *Talpinæ*, has the pterygoid region of the skull only moderately inflated, a manubrium sterni short in comparison with that of *Scalops* and the like, and the clavicles somewhat elongated. In all these respects it shows a leaning toward the genera which are placed in the subfamily *Mygalinæ*.

On the other hand, *Neürotrichus*, a member of the *Mygalinæ*, has a considerably inflated pterygoid region.

Further, it is perhaps questionable whether such a subdivision of the family as that under consideration aids in understanding the phylogeny of the group. I doubt whether the American genera *Scalops* and *Scapanus* have been connected with the true European moles (*Talpa*, etc.) at any recent time. *Condylura* is a greatly modified genus, having no representative in Europe, though possibly remotely connected with *Urotrichus*, through *Neürotrichus* and *Parascalops*. The genus *Neürotrichus* is, of course, very closely allied to *Urotrichus*, but this is the only case in which an Old World type is represented in the New World. The moles are an old family, and very little is known of their geological history. Hence, in my opinion, speculations as to the derivation of the various forms now existing and their true relationships are in many cases of little value. We have among American mammals both forms which are (geologically speaking) quite recent importations from the Old World, and others which are indigenous, or at least have had representatives on the American continent for a very long time. So far as the moles are concerned the present condition of knowledge is not such as to enable us in the majority of cases to distinguish between the two classes. At all events it does not seem to



PELVES OF MOLES.

Fig. 1, Scapanus. Fig. 2, Scalops. Fig. 3, Parascalops. (Twice natural size.)

[1] Monogr. Insectivora, part 2, 1883, p. 128.

me that the finding of *Neürotrichus*, a close ally of *Urotrichus*, in America is a sufficient basis for regarding all the American moles as importations from the Old World.

As regards the position of the American moles in the classification employed by Dr. Gill and modified by Dr. Dobson, it may be remarked first that *Condylura* is very properly placed in a separate supergenus (*Condyluræ*), as this form is an isolated one, presenting many peculiarities not shared by the other genera. The supergenus *Scalopes*, which comprises *Scalops* and *Scapanus*, I can not accept, since *Scapanus*, as here used, includes *Parascalops*, which I think should be separate.

Brewer's mole, *Parascalops*, shows considerable affinity with *Condylura* in the form of the pelvis, the tympanic bones, and the molars, but in most other characters it is, of course, remarkably different.

I regard *Parascalops* as bridging over in some degree the gap between the aberrant *Condylura* and the very closely allied genera *Scalops* and *Scapanus;* but, on the other hand, the remark of Flower and Lydekker that *Scapanus* and *Parascalops* "have a dentition like *Condylura*,"[1] does not seem to me warranted.

The American genera of moles may be arranged as follows:

KEY TO THE GENERA OF AMERICAN MOLES.

A. Subfamily Talpinæ.—Pterygoid region of skull inflated; no distinct pterygoid fossa. Clavicle short and broad. Carpus with an *os falciforme.*

a. Pelvis with two bony bridges connecting the sacral vertebræ with the ischium. Tympanic bullæ complete. Molars with a narrow, simple internal basal projection.

aa. Premolars $\frac{3}{3}$. No functional lower canine; lower incisors, two. Second and third upper incisors, minute ..... *Scalops*
Type: *Scalops aquaticus.*

bb. Premolars $\frac{3}{4}$ or $\frac{4}{4}$. Lower canine present; lower incisors, three.. *Scapanus*
Type: *Scapanus townsendi.*

b. Pelvis with no osseous bridges between the sacrum and ischium. Tympanic bullæ incomplete. Molars with a wide, trilobed basal projection.

cc. Premolars $\frac{4}{4}$, the anterior ones simple and close together. Nostrils simple ..... *Parascalops*
Type: *Parascalops breweri.*

dd. Premolars $\frac{4}{4}$; the anterior ones spaced, multicuspidate and two-rooted. Nostrils in a large fringed cutaneous disk ..... *Condylura*
Type: *Condylura cristata.*

B. Subfamily Mygalinæ.—Pterygoid region of skull not inflated; pterygoid fossa more or less distinct. Clavicle longer than broad. Carpus without an *os falciforme.*

ee. Front upper incisors broad. Premolars $\frac{3}{3}$ ..... *Neürotrichus*
Type: *Neürotrichus gibbsii.*

GEOGRAPHICAL DISTRIBUTION OF MOLES.[2]

The distribution of the several species of American moles is of interest from many points of view. Whether the moles are confined

[1] Mammals, p. 630.

[2] In the preparation of this revision, which has suffered numerous interruptions, I have had the use of several collections besides that of the National Museum. I am

within the faunal areas outlined by students of zoo-geography, from the investigation of other groups, whether their present distribution is fortuitous, or dependent on ascertained or ascertainable conditions of the environment, and what renders these conditions of importance, are among the questions which deserve consideration.

We have in North America, as already intimated, five genera of moles, *Scalops*, *Scapanus*, *Parascalops*, *Condylura*, and *Neürotrichus*. Two of these, namely, *Scapanus* and *Neürotrichus*, are Pacific Coast genera. Though the two genera are not closely related, their distributional areas coincide, but *Neürotrichus*, so far as known, extends by no means so far south as *Scapanus*.

East of the Rocky Mountains are the three remaining genera, *Scalops*, *Condylura*, and *Parascalops*. The last two, as in the case of the west coast genera, coincide in distribution to the extent that *Parascalops* occurs over the middle and southern portions of the area occupied by *Condylura*, and not elsewhere. But, so far as known, it does not range nearly so far north or west. Finally, *Scalops* has a range much exceeding that of the other two genera, with boundaries coinciding for no considerable distance in any direction.

Thus, while two or even three genera of moles will be found in a single locality, no two are found everywhere together. Though the east or west boundaries of two genera may coincide, the north and south boundaries fail to do so, or vice versa; or at least the area of the one genus will be found to exceed that of the other in some direction.

As already stated, such coincidences as do occur are not correlated with nearness of relationship, a fact which finds many parallels in the class of mammals generally.

The two investigators who have given most attention to the study of the geographical distribution of American mammals in recent years are Dr. J. A. Allen and Dr. C. H. Merriam.[1]

The systems of these two writers, based on the effects of climate, while they lead in the main to similar results, proceed from somewhat different principles, Dr. Merriam giving almost exclusive attention to temperature effects and relegating the moisture to an entirely secondary

indebted to Dr. C. Hart Merriam for the use of the very large collection made under his direction for the United States Department of Agriculture and of valuable specimens of *Condylura*, *Parascalops*, etc., from his private collection; to Dr. J. A. Allen, for the use of the collection of the American Museum of Natural History, New York; and to Mr. S. N. Rhoads, for opportunities to examine various interesting specimens in his private collection and in the Academy of Natural Sciences, Philadelphia. To these naturalists, and to the authorities of the institutions mentioned, I offer my sincere thanks, remembering their forbearance in allowing me to retain the collections for a very considerable period of time.

[1] J. A. Allen: The Geographical Distribution of North American Mammals. Bull. Amer. Mus. Nat. Hist., IV, 1892, pp. 199–244.

C. H. Merriam: North American Fauna, No. 3. The Geographical Distribution of Life in North America. Proc. Biol. Soc., Washington, VII, 1892, pp. 1–64. Laws of Temperature Control of the Geographic Distribution of Terrestrial Animals and Plants. Nat. Geog. Mag., VI, 1894, pp. 229–238, pls. 12–14.

place, while Dr. Allen views the effects of moisture as of a higher importance, in some cases surpassing those of temperature. A brief quotation from these two authors will reveal their respective attitudes.

In this latest paper Dr. Merriam remarks:

> Humidity and other secondary causes determine the presence or absence of particular species in particular localities within their appropriate zones, but temperature predetermines the possibilities of distribution; it fixes the limits beyond which species can not pass, it defines broad transcontinental belts within which certain forms may thrive if other conditions permit, but outside of which they can not exist, be the other conditions never so favorable.[1]

Dr. Allen remarks:

> Of strictly climatic influences, temperature is by far the most important, although moisture plays an influential part.
>
> Moisture alone may determine the character of life over extensive regions, regardless of temperature, which, under ordinary conditions, is the ascendant controlling influence.

The terminology employed by Dr Allen is the more precise, and as he pays more attention to moisture in his faunal map than does Dr. Merriam, his system will receive the larger share of attention in the present connection.

It will be impossible to describe here in detail the regions laid down by Dr. Allen, and the reader is referred to his original maps and to those of Dr. Merriam.

The territory of the United States, with the exception of the principal mountain ranges and the addition of the Mexican plateau, is practically coextensive with the faunal area called by Dr. Allen the "Warm temperate subregion." This territory is divided by a north and south line, running a little east of the one hundredth meridian, into two "provinces"—the "humid" of the east and the "arid" of the west. The dividing line between these two provinces is a natural one, and one of much importance in connection with the group of animals we are now studying. As Dr. Allen remarks in regard to his two provinces, "they are not separated by isothermal lines, trending in an east and west direction, but by a north and south line, determined by the amount of rainfall. Thus, in the present instance, temperature as a climatic influence governing the distribution of animals and plants is subordinated to the other climatic influence, humidity, which varies greatly in these two contrasting regions, in consequence of the long continued peculiar physiographic and geographic conditions of the two regions."[3]

North of the warm temperate region extends the cold temperate, stretching away northward to the limit of trees and southward along the principal mountain chains of the United States; also including the larger part of Maine, New Hampshire, and Vermont, together with northern Michigan, Wisconsin, Minnesota, and Dakota.

[1] Nat. Geog. Mag., VI, p. 238.

[2] Bull. Amer. Mus. Nat. Hist., IV, pp. 199, 200.

[3] Bull. Amer. Mus. Nat. Hist., IV, p. 230.

The most northern division of Dr. Allen's warm temperate subregion is separated under the name of the Alleghanian fauna. This includes the greater part of the northern tier of States (east of the one hundredth meridian), lower Canada, northeastern Ohio, the greater part of New York and Pennsylvania, and of the New England States (except the most elevated portions), and the Alleghanies. In Dr. Allen's system, therefore, this region is a part of the larger southern one.

Dr. Merriam looks upon this area as a neutral zone, connecting the northern and southern, but possessing no individuality of its own. He styles it the "transition zone." It is with this area that we are most concerned.

Upon examination of the maps which follow (pp. 28, 55, 74, 89, 103), it will be found that the boundaries of the areas of the several eastern genera coincide in some part with those of the faunal areas just mentioned.

Thus, the area of *Scalops* is almost exactly coextensive with and coincident with the humid province of the warm temperate subregion as marked out by Dr. Allen. But it goes a little farther west toward the one hundredth meridian and a little farther south to the Rio Grande (and perhaps a short distance south of it). Also, there is no certain evidence that *Scalops* reaches North Dakota and Manitoba. Except in these details the genus is strictly representative of the humid province.

There is, however, a certain peculiarity of the distribution of the genus that requires mention. It unquestionably occurs in the Alleghany Mountains—that is, in the southern extension of the cold temperate or boreal area.

In this particular, at least, following Dr. Allen's ideas, its distribution is not controlled by temperature, and we shall need to ask the question, Why does not this mole range farther north?

If we revert here to Dr. Merriam's system, we escape this difficulty, because the Alleghanies in his latest map are represented as belonging entirely to the "transition" zone, which is neutral and in which we may expect to find southern as well as northern forms.

The range of the genus *Condylura*, as will appear from examination of the map, is less in harmony with Allen's faunal areas. Thus, it extends to Hudson Bay on the north, to Indiana, Ohio, and the Alleghanies on the south, and also leaves the mountains and extends somewhat over the lower lands, to the east of them.

The genus, therefore, occupies at once parts of both the cold temperate and warm temperate regions, and, so far as one genus goes, tends to negative the distinctions made between these faunal regions, or at least to indicate that the "Alleghanian fauna" is not part of the warm temperate subregion. The matter assumes a more satisfactory aspect when viewed in connection with Dr. Merriam's scheme. In the terminology of his system, *Condylura* occupies a portion of the boreal region and of the transition zone, and a number of isolated fragments or islands of the latter to the south and east of the main area. Viewed

in this way, the distribution of the genus is not exceptional, but we shall still be obliged to inquire why it occupies only so small a part of the cold temperate or boreal subregion.

The genus *Parascalops*, as already stated, has a similar distribution to that of *Condylura*, but, so far as known, extends neither so far north nor so far west. It appears to remain entirely within the Alleghanian fauna (or transition zone), but does not occupy the whole of the area.

The two western genera, *Scapanus* and *Neürotrichus*, are found exclusively in the Pacific Coast States, with the addition, as far as known, of only a small area immediately northward, and in the case of one specimen, the San Pedro Martir Mountains in Lower California.

In the Pacific States these genera are confined to the area called cold temperate by Dr. Allen, or the boreal and transition areas of Dr. Merriam. In other words, they inhabit only the higher and better watered regions in the south, spreading out more and descending lower in the north. So far as known, *Neürotrichus* does not range south of San Francisco Bay, and hence does not fill out the whole of the southern extension of the cold temperate, as does *Scapanus*.

Having discussed in general terms the distribution of the several genera, and pointed out the peculiarities of their distribution, it remains to consider the causes of these peculiarities. In other words, it is desirable to inquire into the causes which limit or favor the distribution of the moles.

It is generally agreed, as we have seen, that temperature is the most potent agent in affecting distribution, and that next to it stands humidity. In the case of the moles, however, it would appear that humidity is at least as effective as temperature. This is evidenced in the case of *Scalops*, which occupies the Alleghanies, but stops at the plains. The case of *Scapanus* is probably also one in point, though the conditions here are not so simple. How, we may inquire, do differences in humidity affect the moles? Probably not to any great extent directly, but rather in connection with food supply. The common mole (*Scalops*), at least, lives almost exclusively on earthworms and burrowing insects. It should therefore abound and flourish most where these animals are most abundant and most easily obtainable. The latter condition is equally as important as the first, for while the worms may be abundant they may not be readily obtainable, as for example in rocky areas. If the ground is hard, the mole has great difficulty in traversing it, and he may not be able to sustain himself even in ground which contains more or less of worms and beetles. In regions having a dry summer, during which the ground is parched and made hard, he may subsist only with much difficulty. It is probably a debatable question, however, whether the mole can not dig wherever the worm can bore, but it is quite certain that worms could continue to exist in small colonies where the difficulties of finding them would tax too greatly the powers of the mole.

I have been unable as yet to ascertain anything of a definite character in regard to the distribution of earth worms in the United States, but it is a matter of common experience that such worms, together with soft grubs, etc., are found in abundance only in comparatively moist and light ground. Hence, we may conclude that if moles are not as a rule found in arid regions, it is chiefly, and perhaps solely, because sufficient food is unobtainable in such places. If moles are not found in the hot Sacramento Valley, as appears to be the case, and in the arid portions of southern California, it is not on account of the high temperature, but of the aridity, which causes the lack of an abundant food supply.[1] The western limitation of *Scalops* and the southern limitation of *Scapanus*, as well as the peculiar features of the distribution of the latter genus, are illustrations, in my opinion, of this proposition.

As regards the limitation of the several genera toward the north, the case is different. The western genera *Scapanus* and *Neürotrichus*, so far as known, stop at the Fraser River, British Columbia. In the east, *Scalops* stops at the northern boundary of the warm temperate subregion (except in the Alleghanies, as already explained), while *Condylura* reaches to Hudson Bay. *Parascalops*, as far as known, goes northward only to Maine.

In the case of *Parascalops*, it is perhaps useless to attempt any explanation, as the amount of material at command has been small, and the apparently limited range may be much extended by subsequent researches. At all events, as the genus *Condylura* reaches much farther north, it will not be allowable to hold that *Parascalops* is limited northward by lack of food supply, and there is certainly no lack of humidity.[2]

In the case of the western genera, likewise, there are no known peculiarities of food supply or humidity at the northern limit, as for example at the Fraser River, which can be evoked to explain the termination of the range at this point.

In explanation of the northern limitation of the several genera, therefore, we probably can not do better than to make use of Merriam's theory, which is that "the northward distribution of animals and plants is determined by the total quantity of heat, the sum total of effective temperatures."[3] This implies that the several species of moles can not reproduce their kind at more northerly points for want of a sufficient amount of heat during the year. This theory does not, of course, explain why different species require a varying total of heat, some more and some less. Furthermore, it does not take into consideration the direct effect of cold on animals, nor the effects of accumulated snow,

[1] Eisen has described earthworms from Fresno, but whether from garden spots or the open fields I do not know.

[2] I have taken an earthworm out of the stomach of a star-nosed mole from Moose Factory, Hudson Bay territory, so that there can be no question that these worms occur there.

[3] Nat. Geog. Mag., VI, p. 236.

nor the ability or inability of different mammals to hibernate. Nevertheless, Dr. Merriam has shown that a relation exists between faunal areas which have been recognized for a long time, and the total amount of heat in those areas, and his theory is therefore deserving of serious consideration.

A feature in the distribution of the northern genera which merits attention is their failure to cover the entire areas which on theoretical grounds are suitable for them. Why does not *Condylura* occupy British America generally, the northern Rocky Mountains, etc.? Why does *Parascalops* stop in eastern Ohio instead of accompanying *Condylura* westward to Minnesota? Why does not *Neürotrichus* occupy the mountain ranges of southern California with *Scapanus*, and why do not these two genera spread out eastward over the northern Rocky Mountains? I appreciate the fact that subsequent researches may show that these genera really do have a more extensive range than is now indicated, but in the present state of knowledge these peculiarities of distribution remain unexplained. It is improbable that in all cases the range will be hereafter shown to be greatly extended.

As regards *Scalops*, there is no temperature barrier to prevent its extension across the Plains, and even to the Pacific Coast. That it falls short is evidently due, as already insisted upon, to the condition of the environment as regards humidity.

DENTITION.

The formulæ for the dentition of the American genera of moles are given by Dobson as follows:

Condylura, i, $\frac{3}{3}$; c, $\frac{1}{1}$; pm, $\frac{4}{4}$; m, $\frac{3}{3}$.
Scapanus, i, $\frac{3}{3}$; c, $\frac{1}{1}$; pm, $\frac{4}{4}$; m, $\frac{3}{3}$.
Scalops, i, $\frac{3}{2}$; c, $\frac{1}{0}$; pm, $\frac{3}{3}$; m, $\frac{3}{3}$.
Neürotrichus, i, $\frac{3}{3}$; c, $\frac{1}{1}$; pm, $\frac{3}{3}$; m, $\frac{3}{3}$.

In the large series of skulls to which I have had access, are several of each genus sufficiently young to show the milk dentition and the sutures between the various bones. A study of these specimens leads to some rather interesting results. I find that formulæ based on the position of the suture between the premaxilla and the maxilla deviate in some instances from those given above. If the position of the suture must be rigidly considered in identifying the canine, some formulæ now in current use must be abandoned. A similar dilemma seems to have been met with in connection with the European genus *Talpa*, for Professor Flower remarks, in Mammals Living and Extinct (p. 23):

> It happens conveniently for our purpose that in the great majority of cases the segmentation of the (maxillary) bone coincides with the interspace between the third and fourth tooth of the series; still when it does not happen to do so, as in the case of the mole, we must not give too much weight to this fact, if it contravenes other reasons for determining the homologies of the teeth.

Now, it so happens that in *Scapanus* and *Parascalops* the position

of the suture is such that if used exclusively in determining the homology of the teeth, as already stated, very different formulæ from those ordinarily accepted are obtained. Accepting Professor Flower's dictum, what reason is there for ignoring the position of the suture? The reason is this: It is a well-known fact that in most placental mammals the first premolar is without a milk predecessor. If, therefore, we find a tooth close to the intermaxillary suture, which is without a predecessor, we may conclude that this tooth is the first premolar. We may expect to find also a corresponding tooth in the lower jaw.

In examining carefully the young skulls already mentioned, I find this first premolar in many cases without difficulty and with certainty, and I will now proceed to give conjointly the formulæ obtained by employing the two methods of determination.

For *Scapanus* we have the following:

Formula by premolar: i, $\frac{2}{3}$; c, $\frac{1}{1}$; pm, $\frac{4}{4}$; m, $\frac{3}{3}$.
Formula by suture: i, $\frac{2}{2}$; c, $\frac{1}{1}$; pm, $\frac{3}{4}$; m, $\frac{3}{3}$.

In this genus, as will be observed, the intermaxillary suture comes between the second and third anterior teeth, and if employed in identifying the teeth, gives the genus but two incisors on each side. The formula based on the first premolar is more in harmony with general considerations.[1]

The genus *Parascalops* gives exactly the same results as *Scapanus*, though the material in this case is hardly as satisfactory.

The genus *Scalops* gives the following results:

Formula by premolar: i, $\frac{3}{3}$; c, $\frac{1}{1}$; pm, $\frac{3}{3}$; m, $\frac{3}{3}$.
Formula by suture: i, $\frac{3}{3}$; c, $\frac{1}{1}$; pm, $\frac{3}{3}$; m, $\frac{3}{3}$.

In this genus there is no difference in the formula whether based on the position of the suture or on the premolar. A more important matter here is the question of the presence of a third lower incisor and lower canine. The formula as given by Mivart, Dobson, and others is i, $\frac{3}{3}$; c, $\frac{1}{1}$. But I find that in young skulls there are two small teeth behind the second lower incisor, and what is considered to be the first premolar. While these are like milk teeth in their simple form, their position would appear to indicate that they do not belong to the milk dentition, but to the permanent dentition. From the reduction of the jaw they have become minute, and disappear before full growth is attained. In the discussion of individual variation in the genus *Scalops* (p. 37) I shall show that youngish skulls of this genus often present at least a rudiment of the posterior of these two minute teeth and occasionally a well-developed tooth. It appears probable, therefore, that in the lower jaw a reduction of the third and fourth teeth has taken place, similar to that which has affected the second and third teeth of the upper jaw, but the process has been carried further. It

[1] *Scapanus anthonyi* is here left out of consideration, as it is based on a single adult specimen.

may be remarked that the minute teeth of the upper jaw have milk predecessors.

In view of what has just been stated, the formula, i, $\frac{3}{3}$; c, $\frac{1}{1}$, ought to be used in comparative tables for the permanent dentition, but, of course, with the explanation that the formula i, $\frac{2}{2}$, c, $\frac{1}{0}$ represents the functional dentition, so far as incisors and canines are concerned.

In the case of the genus *Condylura* the material at command is insufficient. None of the young skulls have more than a small part of the milk dentition, and they are also broken in such a manner as to defeat critical examination. In skull No. 2094, Bangs' collection, the fourth upper tooth stands in the suture and may be recorded as a canine. The formula, according to the suture, therefore, would be i, $\frac{3}{3}$; c, $\frac{1}{1}$; pm, $\frac{4}{4}$; m, $\frac{3}{3}$, which must be accepted at least until the full milk dentition can be examined.

In the genus *Neürotrichus* there is no tooth in the series anterior to the molars which has not a milk predecessor. There are three teeth in each side of the premaxillary bone, and in the suture appears a large fourth tooth, which must be reckoned as a canine. The milk predecessor of this tooth stands behind it quite independently, the large tooth pointing backward and the small one forward. The two teeth which come next have milk predecessors implanted over them. Thus it appears that there is no premolar without a predecessor. It is only natural to suppose that the first premolar is absent and that those which are present are the second and third. Allowing this to be the case, we have, deciding by the suture, the following formula: i, $\frac{3}{3}$; c, $\frac{1}{1}$; pm, $\frac{3}{3}$; m, $\frac{3}{3}$.

This is the same as the formula adopted by Dobson.

To summarize, the formulæ of the different genera are as follows:

Scalops, i, $\frac{3}{3}$[1]; c, $\frac{1}{1}$[1]; pm, $\frac{3}{3}$; m, $\frac{3}{3}$.
Scapanus, i, $\frac{3}{3}$; c, $\frac{1}{1}$; pm, $\frac{4}{4}$; m, $\frac{3}{3}$.
Parascalops, i, $\frac{3}{3}$; c, $\frac{1}{1}$; pm, $\frac{4}{4}$; m, $\frac{3}{3}$.
Condylura, i, $\frac{3}{3}$; c, $\frac{1}{1}$; pm, $\frac{4}{4}$; m, $\frac{3}{3}$.
Neurotrichus, i, $\frac{3}{3}$; c, $\frac{1}{1}$; pm, $\frac{3}{3}$; m, $\frac{3}{3}$.

COLOR OF MOLES.

The color variations of moles are of much interest, as the style of coloration is of the simplest character, and the complexity caused by the appearance or disappearance of spots, lines, etc., is absent. The various species belonging to the several genera do not exhibit the same degree of variation, *Parascalops*, *Condylura*, and *Neürotrichus* exhibiting but little, *Scapanus* a moderate amount, and *Scalops* more.

The variations of *Scalops* are geographical, the main departure from the mean of coloration being in the Northwest and Southwest. In the Mississippi Valley generally, but particularly in southern Minnesota and Wisconsin, there is a tendency to increase in pallor, producing a

[1] Persistent canines and incisors = i, $\frac{3}{3}$; c, $\frac{1}{1}$.

general silveriness of coloration. In southwestern Texas the color assumes more or less of a buff tint, sometimes quite pale and clear and very striking.

This alteration, so far as I am able to judge, has nothing directly to do with the color of the soil. The change in Illinois and the surrounding parts of the Mississippi Valley should be toward black, if the object were to reach a coloration in harmony with that of the soil, whereas whatever change is perceptible is in the opposite direction. The alteration in the Northwest and Southwest likewise is apparently due to the comparative aridity of the regions, the color of the Texan form being different from that of the Northwest, because the parent form is somewhat different in color in the two cases.

On the west coast, as on the east, the change of color is chiefly one of intensity, and runs parallel with the increase or decrease of humidity, as is the case with so many of our mammals. The changes here in *Scapanus*, taken as a whole, are much more striking than those in *Scalops* of the East. In the region of great precipitation, in western Washington and Oregon, the moles are nearly black. In northern California the color is lighter and browner, and in southern California tends to silvery tints. Here again, as far as my observations go, the color of the soil has little to do directly with that of the moles. A soil is, of course, darker when wet than when dry, but the soil about Puget Sound is not especially dark, and certainly does not correspond with the dusky appearance of the moles.

Possibly we should not expect to find any correspondence, for while the mole is in its burrow its color or that of the soil can be of little consequence.

We appear to have in the varying intensity of color in moles a purely physiological phenomenon connected with humidity and light. Exactly how humidity affects color is not evident, though there can be little doubt of the fact. So far as I have observed, recent writers, as for example Beddard or Poulton, do not offer any explanation of this phenomenon, though aware of its occurrence.

It has to be remembered in this connection that *Neürotrichus*, which is found with *Scapanus* and *Parascalops*, and *Condylura*, which are found with *Scalops*, do not change in color in any marked degree.

VARIATION IN SIZE.

It is noticeable that in the genera having the smallest range and the least variation in color, the variation in size is also at a minimum. In *Condylura*, *Parascalops*, and *Neürotrichus* there is little variation, while in *Scalops* and *Scapanus* it is marked. In the case of the last two genera, the smallest representatives scarcely exceed one-half the length of the largest.

So far as the causes of this variation are apparent, they have to do with the food supply. In the case of *Scalops*, the variation is exceedingly gradual on the Atlantic Coast, the size decreasing from north to

south, as is the case with so many other North American mammals. West of the Alleghanies, however, *Scalops* maintains large size over a wide area, without regard to latitude. On the west coast, *Scapanus californicus* decreases gradually in size from north to south, as does *Scalops* on the east coast.

In cases where the conditions are simple, size may be supposed to depend upon the amount of energy expended in obtaining a given amount of food.[1] This relation would at first affect the individual, and finally the race.

A light, moist, fertile soil would contain the greatest number of earthworms and beetles and be most easily worked; hence the moles would be large.

Where the soil was dry and hard, worms and insects would be fewer and the exertion of finding them great; here we should expect to find small moles.[2]

As we have shown above, these anticipations are fulfilled in the different parts of the range of *Scalops* and *Scapanus*.

One feature of the moles as regards size remains to be mentioned. The largest moles are found at the northern boundary of the range in the case of *Scalops* and *Scapanus*. There is no gradual diminution as the limit is reached.[3]

It is not entirely clear what is the cause of this phenomenon. We might suppose, in accordance with the terms of Dr. Merriam's theory, that although food was most plentiful near the northern limit, and hence size large, a point was suddenly reached where the total amount of heat was insufficient for reproduction, and the moles, though abundantly nourished, ceased to propagate. This at first would seem to be a satisfactory explanation; but that it does not really explain the matter will appear from a consideration of the effect of cold on plants. The willows, which are goodly trees in the temperate zone, grow smaller and smaller northward, till in the Arctic they are dwarfed to such an extent that they will rise only a few inches above the ground, or even trail along it like a vine; yet they flower profusely and their catkins are of a very large size. We might expect to find something analogous in connection with the moles, but, as we have seen, quite the reverse occurs. They cease when their size is at a maximum.

[1] "The available supply of assimilable matter being the same, and other conditions not dissimilar, the degree of growth varies according to the surplus of nutrition over expenditure—a generalization which is illustrated in some of the broader contrasts between different divisions of organisms, and is a direct corollary from the resistance of force." Spencer, Principles of Biology, I, 1881, p. 131.

[2] In this connection it may be interesting to note the fact that in the hard clay soil of the District of Columbia I find that the earthworms are collected in summer in colonies under stones or cow dung, leaving large areas unoccupied, through which a mole might tunnel in vain, expending a large amount of energy, with no return.

[3] Leaving out of consideration the small *Scapanus orarius* which lives with the large *Scapanus townsendi* at the northern part of its range, but does not appear to intergrade with it.

Some considerations of a different character may throw light on the problem as far as concerns *Scalops*. It will be noticed upon examination of forestry maps of North America[1] that the coniferous forest terminates on the south at the exact point where the moles reach their northern limit. It would appear as if these forests prevented the further northward distribution of *Scalops*. This is not at all improbable, though it is likely that their effect is indirect rather than direct. Adopting this view, we may look upon *Scalops* as a northern genus whose proper northern extension has been reduced by the growth of coniferous forests.[2] As the whole family *Talpidæ* is of northern origin so far as known, this view is perhaps not without force.

Family TALPIDÆ.

Diagnosis.—Small insectivora. Humerus articulating with both scapula and clavicle. Clavicles reduced in length. An elongated manubrium sterni. Acetabula closely approximated. Eyes minute. No ear-conch (except in *Uropsilus*). Molars three on each side of either jaw; incisors not exceeding four; premolars not exceeding four. Molars broad, with W-shaped external cusps, and an internal basal ledge.

Zygomatic arches complete. Tympanic bullæ more or less complete. Lumbar vertebræ with hypapophysial ossicles. No symphysis pubis.

The first paragraph of this diagnosis contains all the characters by which this family can be clearly separated from the other families of the order. The typical moles, such as *Talpa*, *Scalops*, etc., are, of course, readily separable, from the representatives of other families, but many of the distinctions break down in such forms as *Neürotrichus*, *Uropsilus*, etc.

Thus, the radial sesamoid, characteristic of the manus of the typical moles, is absent in *Urotrichus*, *Uropsilus*, etc. An ear-conch, which is absent in the typical moles, is present in *Uropsilus*.

Many characters which are sufficiently diagnostic in combination are, nevertheless, shared by the representatives of other families. Thus, the peculiar hypapophysial ossicles of the lumbar vertebræ occur also in the *Erinaceidæ*.[3] Complete zygomatic arches occur in *Chrysochloridæ* and *Erinaceidæ* as well as in the moles. The *Chrysochloridæ* and *Potamogalidæ*, like the moles, are without true symphysis pubis.

The moles are on the whole more nearly related to the shrews than to any other insectivores, and the more aberrant forms, like *Urotrichus* and *Uropsilus*, bear a strong external resemblance to the shrews. Still there are no moles without zygomatic arches and none with the long-

[1] See Forestry Report, Tenth Census, by Sargent.

[2] It is a singular fact that where the coniferous trees are cut down, as, for example, in Alaska, they are replaced by deciduous trees. When the woodman's ax has passed over the Alaskan forests, therefore, we may expect to find that territory covered by deciduous trees.

[3] What is more remarkable these ossicles occur also in *Perameles*, a marsupial mammal.

crowned incisors of the shrews. In this latter character *Condylura* shows, perhaps, the nearest approach to the shrews, but it is nevertheless a true mole.

Genus SCALOPS Cuvier, Illiger.

Scalops, CUVIER, Leçons d'Anat. Comp., I, 1800 (Tableau Gén. Classif. Anim.). (No description or type.)

"*Scalops*, Cuvier," ILLIGER, Prodromus Syst. Mamm. et Avium., 1811, p. 126. Type: *Sorex aquaticus*, Linnæus.

Talpasorex, LESSON, Manuel de Mammalogie, 1827, p. 124. Based on Harlan's *Scalops pennsylvanica*. (Not *Talpasorex*, SCHINZ.)

Skull with marked interorbital constriction. Palate extending back behind the last molars. Tympanic bullæ complete. Pelvis with two bony bridges connecting the sacral vertebræ with the ischium. Functional dentition: i, $\frac{3}{2}$; c, $\frac{1}{0}$; pm, $\frac{3}{3}$; m, $\frac{3}{3}$. First upper incisor very large; second and third minute. Molars with a narrow, simple anterior internal basal ledge. Nostrils simple, superior. Fore and hind toes webbed. Manus with an *os falciforme*.

This genus was the first of the American forms to be separated from the comprehensive Old World genus *Talpa*. Though given a name in 1800 by Cuvier, it was not really characterized until 1811, when Illiger gave a diagnosis and specified a type. It has been generally considered as not nearly allied to the Pacific Coast genus *Scapanus*, on account of the differences in dentition. I have found, however, that these differences are not so great as has been supposed, while on the other hand the skeleton and skull present very great similarities in contrast with the genus *Parascalops*.

The genus is distinguishable by external characters, of which the principal are the webbed condition of the forefeet and the superior position of the nostrils.

SCALOPS AQUATICUS (Linnæus).

EASTERN MOLE.

Sorex aquaticus, LINNÆUS, Syst. Nat., 10th ed., 1758, p. 53.

Talpa europæa flavescens, ERXLEBEN, Syst. Reg. Anim., 1777, p. 118.

Talpa europæa, flava, GMELIN, Linn. Syst. Nat., 1788, p. 110.

Talpa flava, KERR, Anim. King., 1792, p. 201.

Talpa fusca, KERR, Anim. King., 1792, p. 202; SHAW, Gen'l Zool., I, 1800, p. 524.

Scalops canadensis, DESMAREST, Mammalogie, 1 part., 1820, p. 155.—HARLAN, Fauna Amer., 1825, p. 32.

Scalops pennsylvanica, HARLAN, Fauna Amer., 1825, p. 33.

Scalops aquaticus, F. CUVIER, Dents des Mamm., 1825, p. 251, No. 22.—FISCHER, Synop. Mamm., 1829, p. 249.

Talpa (*Scalops*) *Virginiana*, DE BLAINVILLE, Osteographie, Atlas, I, 1839–1864, table des planches, p. 4; Insectivores, pl. V (skull), pl. IX (teeth).

Talpa pennantii, LE CONTE, Proc. Acad. Nat. Sci. Phila., VI, 1853, p. 327.

Talpa aquatica, LE CONTE, Proc. Acad. Nat. Sci. Phila., VI, 1853, p. 327.

Talpa cupreata, RAFINESQUE, Precis des decouv. et travaux somiologiques, Palerme, 1814, p. 14.

"Purple species," HARRIS, New England Farmer. [Fide LE CONTE.]

Diagnosis of species.—Snout simple, depressed; naked above as far back as the line of the anterior incisors. Nostrils simple, superior, with two minute papilliform processes within. Eye and auditory orifice minute and concealed in the fur. Palm as long as the sole, but two and one-half times as broad. Tail short, slender, and terete; the proximal third clothed with long hair like that of the body, and the remainder with sparse, short hairs. Color brownish gray, varying to silvery gray and to creamy buff. Hairs of feet and tail white.

KEY TO SUBSPECIES OF SCALOPS AQUATICUS.

a. Size medium (average total length 162 mm.). Color shining gray-brown. *typicus*, p. 20.

b. Size very small (average total length 142 mm.). Hind foot long. Tail short. Color as in *a*. Skull and teeth delicate; coronoid process slender, uncinate. *australis*, p. 21.

c. Size very large (average total length 190 mm.). Tail and hind feet long. Color inclining to silvery. Skull massive; molars large and quadrate; coronoid process triangular..... *machrinus*, p. 20.

d. Size very small, as in *australis* (average total length 139 mm.). Wrists and base of snout in males bright rusty orange. Skull and teeth massive, frontal sinuses enlarged; coronoid process stout..... *texanus*, p. 21.

DIAGNOSES OF SUBSPECIES.

SCALOPS AQUATICUS TYPICUS.

EASTERN MOLE.

Diagnosis.—Average total length, 162 mm.; tail one-sixth of the same, and hind foot one-eighth; dentition moderate; coronoid process of mandible heavy, scarcely uncinate, with a more or less distinct mammiform tubercle on the posterior margin; color nearly uniform shining grayish hair-brown; grayer and more silvery below; all the fur of the body plumbeous at the base; hairs of the feet and tail white.

SCALOPS AQUATICUS MACHRINUS (Rafinesque).

PRAIRIE MOLE.

Talpa machrina, RAFINESQUE, Atlantic Journal, 1832, p. 61.

Talpa sericea, RAFINESQUE, Atlantic Journal, 1832, p. 61 (Young).

Scalops argentatus, AUDUBON & BACHMAN, Journ. Acad. Nat. Sci. Phila., VIII, 1842, p. 292.

Scalops aquaticus argentatus, COUES, Bull. U. S. Geol. and Geog. Survey Terr., III, No. 3, 1877, p. 633.

? *Talpa Pennantii*, LE CONTE, Proc. Acad. Nat. Sci. Phila., VI, 1853, p. 327.

Diagnosis.—Size the maximum for the species. Total length, average, 188.7 mm.; skull, average, 37.1 mm. Tail and hind foot proportionally longer than in the typical form. Teeth large. Coronoid process of mandible triangular, large, with usually a straight posterior margin. Color as in the typical form, or a little paler.

Average dimensions from fresh specimens (6 from Illinois): Length of head and body, 154.9 mm.; tail vertebræ, 33.8 mm. Average dimen-

sion from alcoholic specimens: Total length, 131.3 mm.; head, 49.2 mm.; tail vertebræ, 31.2 mm.; hind foot (without claw), 19.8 mm. Average dimensions of skull (13 from Illinois, Missouri, and Kansas): Total length, 36.8 mm.; greatest breadth, 19.6 mm.; palate length from inside of incisors, 16.5 mm.

Type-locality.—Near Lexington, Kentucky.

Distribution.—Mississippi Valley, from Tennessee and Missouri northward to Wisconsin and Minnesota, and westward to eastern Kansas and Nebraska and southwestern South Dakota. Manitoba (?).

SCALOPS AQUATICUS AUSTRALIS, Chapman.

FLORIDA MOLE.

Scalops aquaticus australis, CHAPMAN, Bull. Amer. Mus. Nat. Hist., V, 1893, 339.
? *Scalops parvus*, RHOADS, Proc. Acad. Nat. Sci. Phila., 1894, p. 157.
? *Talpa cupreata*, RAFINESQUE, Precis des découvertes et trav. Somiologiques, 1814, p. 14.

Diagnosis.—Size much smaller than in the typical form (average total length 142 mm.) and hind foot proportionately long; skull small; teeth delicate; coronoid process slender, uncinate, without a secondary process on the posterior margin; color brownish silvery gray, as in the typical form, but often with rusty spots on the sides of the nose and about the chin and wrists.

Average dimensions.—(9 fresh specimens, males, from Oak Lodge, opp. Micco, Florida; Bangs' Coll.): Total length, 137 mm.; tail, 20.6 mm.; hind foot, 17.1 mm. Alcoholic specimens: Total length, 123 mm.; head, 40.1 mm.; tail vertebræ, 23.4 mm.; hind foot (without claw), 15.1 mm.

Average dimensions of adult skulls (9 males from Oak Lodge, Florida): Total length, 30.8 mm.; greatest breadth, 16.2 mm.; length of palate from inside of incisors, 13.1 mm.

Type-locality.—Gainesville, Florida.

Distribution.—Eastern Florida, south to Lake Worth and Orange Hammock (De Soto County). Western Florida, Tarpon Springs.

SCALOPS AQUATICUS TEXANUS (J. A. Allen).

TEXAS MOLE.

Scalops argentatus texanus, J. A. ALLEN, Bull. Amer. Mus. Nat. Hist., III. 1891, p. 221.
Scalops texanus, J. A. ALLEN, Bull. Amer. Mus. Nat. Hist., V, 1893, p. 200.

Diagnosis.—Size small, as in subspecies *australis* (average total length of males 141 mm.). General coloration as in the typical form, but strongly suffused on the forehead, chin, breast, and wrists with rusty orange-brown.

Skull small, massive. Frontal sinuses enlarged. Mandible deep; coronoid process broad, with a straight posterior margin. Molar teeth large. First upper premolar small.

Average dimensions of fresh specimens (from J. A. Allen): Male, total length, 141 mm.; tail, 25 mm.; hind foot, 17.8 mm. Female, total length, 137 mm.; tail, 23 mm.; hind foot, 16.5 mm.

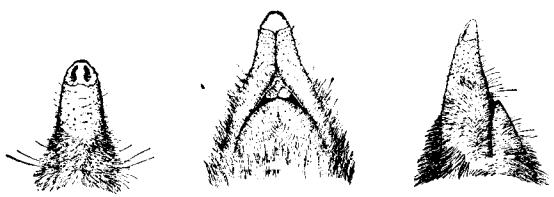
Average dimensions of skull (10): Total length, 30.9 mm.; greatest breadth, 16.7 mm.; length of superior tooth row, 13.9 mm.

Type-locality.—Given by Dr. J. A. Allen as Presidio County, Texas, but believed to be Aransas County.

Distribution.—Coast of Texas.

DESCRIPTION OF SPECIES.

Body fusiform. Fore legs enveloped in the integument of the body as far as the wrists, and the hind legs to the middle of the tibiæ. Palm



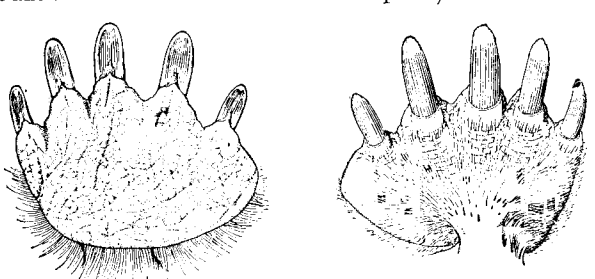
4. 5. 6.

SNOUT OF SCALOPS AQUATICUS.

Fig. 4, Upper surface. Fig. 5, Lower surface. Fig. 6, Side view.

(One and one-third times natural size.)

equal to the sole in length, but two and a half times as broad as the latter. Snout moderately elongated (extending in adults about 10 mm. beyond the upper incisors), depressed, naked on top as far back as the line of the anterior incisors. Nostrils superior, about 2 mm. long,



7. 8.

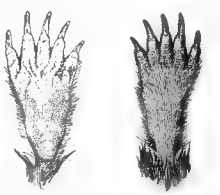
FORE FOOT OF SCALOPS AQUATICUS.

Fig. 7, Lower surface. Fig. 8, Upper surface.

crescentic, close to each other and to the extremity of the snout anteriorly; each bearing two cilia within. Corner of the mouth slightly anterior to the line of the eyes. Upper lip with a narrow ridge on each side.

Eyes minute, but not covered by membrane. No external ears. The auditory orifice (entirely concealed in the fur) minute, circular, situated slightly below the level of the eye and on a line with back of the wrist.

Fore feet very large, broader than long (exclusive of the claws). The palms directed backward, and can not be applied to the ground in walking. Palms as long as the soles, but two and a half times as broad as the latter. Fore toes webbed to the base of the nails, which are long, broad, and depressed, and convex above. Back of the manus covered with short, soft, white hairs, which form a fringe all about the margin. Last joint of the toes naked. Palms naked, with very numerous irregular furrows. Second, third, and fourth digits subequal; fifth a little shorter; pollex still shorter and in a line with the other toes



9. 10.

HIND FOOT OF SCALOPS AQUATICUS.
Fig. 9, Lower surface. Fig. 10, Upper surface.

Hind feet small and narrow, with long, slender, sharp little-curved claws; otherwise like the fore feet.

Tail short, slender, terete, tapering. The proximal third clothed with long hair, like that of the body; but the remainder with rather short and sparse hairs, which do not conceal the skin; a short terminal pencil.

11.
TAIL OF SCALOPS AQUATICUS.
(Natural size.)

Fur very fine, velvety, slightly crenulate, and with broad, shining tips.

General color of the body everywhere nearly uniform shining silvery gray, tinged more or less with brown, varying (in subspecies *texanus*) to pale brown or cream color. Hairs dark plumbeous, except at the extremities. Those on the back of the feet, on the tail, and lower jaw dull white to the base. On the forehead and around the eyes and wrists similar, varying (especially in subspecies *texanus*) to strong rust color.[1]

SKULL.

Skull oval, depressed. Facial portion cylindrical, only slightly sloping from the forehead forward. Anterior nares opening forward. Premaxillæ extending beyond the nasals anteriorly. Nasals triangular,

[1]It may be of interest to note here that parasites are sometimes found on our moles. Two different forms were found on a *Scalops* from Brightwood, D. C., regarding which Mr. Linnell, of the Department of Insects, National Museum, has kindly sent me the following facts:

"The specimens found on a live mole that you sent are as follows:

"1. *Leptinus testaceus* Müll.; a blind beetle, allied to the Beaver louse (*Platypsylla*), found with various small rodents and insectivora, either on their bodies or in their nests. Europe and America.

"2. *Pulex* sp. The species of this group are not worked out yet."

elongated. Zygomatic arch slender, ascending posteriorly. Infraorbital foramen large, oblique. Interorbital area inflated. Parietals broad, triangular, with a concave posterior margin; mastoid and occipital borders equal, mastoids inflated. Foramen magnum high and narrow. Tympanic bullæ complete, rounded, depressed; meatus auditorius externus small. Palate long, moderately concave, with a prominent transverse posterior margin.

Mandible with stout horizontal ramus; ascending ramus very short, and directed backward. Coronoid broad, triangular, and erect; angular process large, oblong, with a rounded margin posteriorly, and concave superior margin. Condyles long, cylindrical, transverse.

TEETH.

Functional dentition: i, $\frac{3}{2}$; c, $\frac{1}{0}$; pm, $\frac{3}{3}$; m, $\frac{3}{3}$; total, 36.

First upper incisors large and long, obtusely pointed, somewhat divergent, convex in front, flat behind. Second and third incisors minute, slender and simple. Canine two-thirds as long as the first incisor, cuspidate. First premolar less than half the size of the canine, simple, unicuspidate. Second and third premolars successively larger, unicuspidate, with a compressed, trenchant posterior margin terminating below in a tubercle. The third with a very small heel (disappearing with age). Molars W-shaped in transverse section with a large V-shaped, antero-internal heel or cusp; first and second subequal and quadrate. Second molar with four external, two internal, and one basal cusp. First and third molars with three external, two internal, and one basal cusp.

First lower incisor small, unicuspidate; second large, elongate, canine-like, grooved internally. Premolars increasing in size from the first to the third; the latter as long as and considerably thicker than the second incisor. The posterior edges of the premolars rather trenchant. Molars W-shaped in transverse section, each with two external and three internal cusps. First and second molars subequal and largest; third smaller.

SKELETON.

The vertebral formula of *Scalops* is given by Cuvier and by Bell as follows: c, 7; d, 12; l, 7; s, 6; ca, 10; total 42. I find by examination of skeletons in the National Museum collection that the normal formula is c, 7; d, 14; l, 5; s, 6; ca, 11; total, 43. One skeleton, while preserving the same number of lumbars, has 15 dorsals, making the total number of vertebræ 44. There are 7 intervertebral ossicles, arranged as in *Scapanus*. The sternum consists of 6 segments and a very large manubrium, which is exactly as long as the combined segments. The first pair of ribs joins the manubrium near the junction of its third and last fourth. The ribs are broad and flat. The upper surface of the manubrium is dilated and grooved, with incurved raised edges.

The keel is triangular, deepest in front.

The clavicles are only two-thirds as long as broad, and are pierced by a foramen. The scapula is very narrow, with high ridges. The acromion is low and long.

The humerus is only a fifth longer than broad.

The pelvis is very narrow, and the bones of the opposite sides are in contact under the acetabulum. The space between the sacral vertebræ and pelvis is entirely covered over above by osseous bridges, leaving only two pairs of small foramina.

The femur is three-fourths as long as the tibia.

The *os falciforme* is long and slender, slightly tapering and curved at the base. The tip reaches to the base of the terminal phalange of the fifth digit.

The terminal phalanges are bifid.

GEOGRAPHICAL DISTRIBUTION.

The area occupied by the genus *Scalops*, as shown by specimens examined in the preparation of this monograph, has the following boundaries: The northern boundary passes through central Massachusetts and central New York to Lakes Ontario and Erie, thence westward to the southern extremity of Lake Michigan, thence in a northwesterly direction across southern Wisconsin to Elk River, Minnesota, and thence southwestward to the mouth of the Big Sioux River, in South Dakota.

The western boundary follows in a general way the ninety-seventh parallel and thus includes the eastern fourth of Nebraska, Kansas, and Indian Territory. Continuing in Texas it bends somewhat to the west and follows the ninety-ninth parallel, terminating in Tamaulipas, about 45 miles south of the Rio Grande.

The southern boundary is the Gulf of Mexico, and in Florida a line connecting Tampa Bay on the west side with Lake Worth on the east.

An examination of numerous faunal records shows that it is necessary to somewhat extend the range as derived from specimens. In the Northeast, for example, the boundaries should include all Massachusetts, on the authority of Dr. J. A. Allen[1] and Emmons,[2] and some part at least of Vermont, on the authority of Thompson.[3] As regards its absence in northern New York, Baird remarks that *Parascalops breweri* is found here "apparently to the exclusion of the more southern species with white naked tail, *S. aquaticus*."[4] I have not met with any record of the occurrence of *Scalops* in New Hampshire. Mr. G. S. Miller, jr. does not include it among the mammals observed by him in the White Mountain region. If there are records of its occurrence in Maine, they have escaped my attention. While in Hancock County in the summer of 1894, I was informed that the mole was found there, but not abundantly. I did not see any evidences of its presence, however, and

[1] Bull. Mus. Comp. Zool., I, 1869, p. 221.

[2] Emmons, Quadrupeds of Mass., 1840, p. 15.

[3] Thompson's Vermont, p. 27.

[4] Fifteenth Rept. State Cab., Nat. Hist., 1862. App. A.

certain runways which were pointed out to me as those of the mole I proved afterwards to be made by meadow mice.

The records relating to Canada are rather conflicting, but there is probably little doubt of the occurrence of the genus in the southern parts. Thus, Audubon and Bachman, speaking in general terms, include Canada in the range.[1]

Couper states that *Scalops* is abundant at Montreal, and occurs also at Quebec, but is not common there.[2] Chamberlain asserts that it is common in New Brunswick,[3] and Dr. J. A. Allen mentions its supposed occurrence in the Tobique River region in this Province, but as specimens were not taken, the matter is open to question. If the mole does occur in New Brunswick, it is, of course, extremely probable that it occurs also in Maine. Gapper included the genus half a century ago in the fauna of the region between York and Lake Simcoe in Upper Canada, but no specimens were seen.[4] Mr. J. B. Tyrrell, in the Proceedings of the Canadian Institute, asserts that it is common throughout eastern Canada,[5] and another writer, in the Naturaliste Canadien, records it as existing in Canada, though it is rare.[6]

Richardson has a theory to account for the absence of the mole in high latitudes, which runs as follows:

> I do not think it [the shrew mole] can exist; at least, on the east side of the Rocky Mountains, beyond the fiftieth degree of latitude, because the earthworm on which the *Scalops*, like the common mole [*Talpa europæa*] principally feeds, is unknown in the Hudson Bay countries. (Fauna Bor. Amer., p. 11.)

Passing to the westward, the next region in which the existence of *Scalops* is questionable is southern Michigan. Miles, in 1861, includes it in the fauna of the State, but his list of mammals is probably a nominal one.[7] Hayden, in giving the range of *S. machrinus*, places the eastern limit at Detroit.[8] I have seen no specimens from the State.

In southern and central Wisconsin and Minnesota the species is known to occur. Dr. E. A. Mearns, U. S. A., collected one at Camp Douglas, in Juneau County, Wisconsin, and Strong remarks its occurrence in the southern and central sections.[9] I know of no record of its existence in northern Wisconsin.

As regards Minnesota, Prof. Otto Lugger wrote me in January, 1896, that he had obtained three specimens—one from Ottertail County, another from Anoka (Anoka County), and a third from Mankato (Blue Earth County). Ottertail County is the most northwesterly locality

[1] Quadrupeds of North America, I, p. 91.

[2] Forest and Stream, newspaper, VIII, p. 300.

[3] Bull. Nat. Hist. Soc. New Brunswick, X, 1892. p. 32.

[4] Zool. Jour., V, 1830, p. 202.

[5] Proc. Canad. Inst., 3 ser., VI, 1888, p. 88. (See Thompson's remarks on the inaccuracy of this list, and the reply, in the same journal, VII, 1889, No. 1, p. 178.)

[6] Nat. Canad., II, p. 44.

[7] Cat. of the Animals of Michigan, 1861.

[8] Trans. Amer. Phil. Soc., new ser., XII, 1863, p. 140.

[9] See Moses Strong in Geology of Wisconsin, I, 1883, p. 438.

from which the species, so far as I am aware, has been obtained. Professor Lugger, however, makes the following statement:

I have seen the undoubted work of the mole at Windom (Cottonwood County), Luverne (Rock County), and Crookston (Polk County).

The last-mentioned locality is of special interest, as it is in the extreme northwest portion of the State. As no specimens were obtained, it is not certain whether this species or the star-nosed mole is the one represented there. Professor Lugger adds:

It is frequently stated that moles are very abundant in Minnesota, yet whenever I tried to obtain specimens the "moles" turned out to be shrews.

The present species is not included by Thompson among the mammals of Manitoba.[1]

For regions west of the boundary as indicated by the specimens used in preparing this paper, there are few references to the occurrence of moles. "Though abundant on the rich bottoms along the Lower Missouri," writes Hayden, "it [*S. argentatus*] is seldom if ever seen above longitude 98 degrees. A single specimen[2] was caught near the mouth of the Big Sioux in the autumn of 1856."[3] On a preceding page he also remarks:

The *Scalops argentatus* has not yet been observed above the mouth of Big Sioux River, and it is not probable that it will be seen above the rich bottom lands which extend only to the Niobrara.[4]

Audubon and Bachman remark:

We did not see any [moles] up the Missouri River and none are found on the dry prairies of the regions immediately east of the great Rocky Mountain chain.[5]

In contradiction to this statement, we have the remark of Col. A. G. Brackett: "I have seen the tunnels of the moles in Wyoming;" and again: "I have seen their excavations on the high plains of the far West."[6]

These assertions need confirmation, as no specimens appear to have been taken, and the circumstances of the case are such as to make it improbable that the mole occurs so far west.

Another record which needs confirmation before it can be accepted is that of Hind, who remarks that on Long Creek, a tributary of the Qu'appelle River, in Assiniboine, "the burrows of moles are very numerous."[7]

[1] Richardson refers to a mole, "species ignota," as inhabiting his "Eastern district," which extended northward from the northern shore of Lake Superior. (Fauna Bor. Amer., p. xxvi.)

[2] This is No. 1760, U.S.N.M.

[3] Trans. Amer. Phil. Soc., new ser., XII, 1863, p. 140.

[4] Op. cit., p. 139, No. 7258, U.S.N.M., collected by Dr. Hayden, is from the "Sand Hills, Nebraska," but the catalogue does not specify from how far west.

[5] Quadrupeds of North America, I, p. 91.

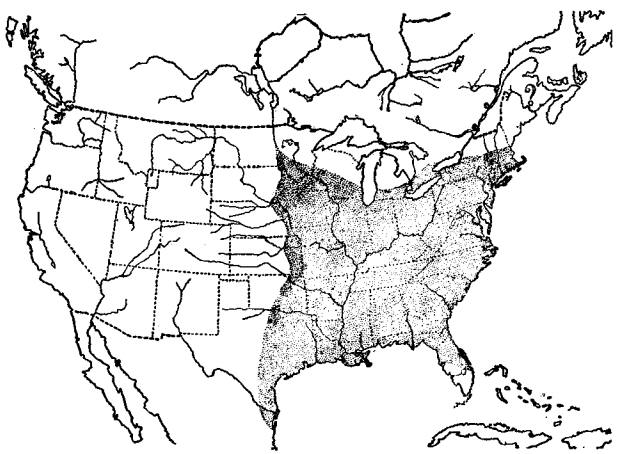
[6] American Field, newspaper, XIX, 1883, p. 130.

[7] Hind, Red River and Saskatchewan Expedition 1, 1860, 406. In this connection it is interesting to recall Richardson's theory that moles can not exist in high

A very extraordinary essay connected with this subject is that of Dr. Robert Bell on "The causes of the fertility of the land in the Canadian Northwest Territories."[1] He advances the theory that the fertility of the soil of the territory stretching northwestward from the Laird River at 60 degrees north latitude, is chiefly or entirely due to the action of moles. He remarks:

> The formation of the vegetable mold in these regions must, therefore, be due to some other agency than that of worms, and this I believe to be principally the moles, which live in vast numbers throughout the region in question. * * * There appear to be three or four different species of them.

He begins the paragraph from which the foregoing sentences are taken with the remark: "As far as I am aware, earthworms are not found in the Northwest."



GEOGRAPHICAL DISTRIBUTION OF SCALOPS.

Taking these statements in connection with others regarding food and habits, it is evident that Dr. Bell has entirely mistaken the nature of the animals he saw, being unacquainted with the appearance and habits of the mole. It seems probable that he really had to do with voles and lemmings.

The common mole is mentioned by Long[2] in the list of animals

latitudes on account of the absence of earthworms (see *ante*, p. 26). Richardson makes a further remark on this subject, as follows: "I was told by a gentleman who has for forty years superintended the cultivation of considerable pieces of ground on the banks of the Saskatchewan, that during the whole of that period he never saw an earthworm turned up." (Fauna Bor. Amer., p. 204, footnote.)

[1] Trans. Royal Soc. of Canada, I, sec. 4, p. 157.

[2] Long's Exped. to the Rocky Mts., I, 1823, p. 369.

observed in 1819 at Engineer Cantonment, which station was located near the present town of Blair, Nebraska. This locality, however, is not quite so far west as Everett (Dodge County), from which place a specimen was obtained for the collection of the Department of Agriculture.

GEOGRAPHICAL VARIATION IN SIZE AND COLOR.

The common mole varies correlatively with its geographical distribution, both in point of size and in color. Generally speaking, the largest individuals are found in the northwestern part of its range—that is, in the States bordering on the Great Lakes and the northern portion of the Mississippi Valley generally. The smallest individuals are from Florida and the Gulf coast of Texas. East of the Alleghanies there is a very uniform diminution in size from north to south, and there is a similar but less gradual diminution in the portion of the range west of the Alleghanies.

The diminution on the Atlantic Coast is well brought out by a comparison of measurements of the total length of adult skulls, as shown in the following table:

Average dimensions of adult skulls of Scalops aquaticus from different localities on the Atlantic Coast.

Locality.	Average total length.	Number of skulls.
	mm.	
Connecticut	35.5	5
New York and New Jersey	35.3	7
Pennsylvania	34.9	4
Maryland and District of Columbia	34.1	7
Virginia	33.4	3
North Carolina	31.8	9
Florida	30.8	9

The Florida specimens, representing the minimum as regards size on the Atlantic Coast, constitute the subspecies *australis* of Chapman. This form has some other characteristics, of course, besides small size, as will be found upon examining the diagnosis already given (p. 20).

On the Gulf coast about the mouth of the Mississippi and farther westward in the same latitudes in Texas and thence southward, the size is still very small, though somewhat larger than on the Atlantic Coast. The skulls of fourteen specimens from points about New Orleans, Louisiana, and thence westward to San Antonio and Mason, Texas, have an average total length of 32 mm. Included here is the form known as *S. texanus*, from Aransas County, Texas, which is practically of the same size as the Florida *S. australis*.

Seven adult skulls from Rockport, in this county, have an average total length of 30.9 mm. If we include skulls from other neighboring parts of the Texas coast (Corpus Christi, Padre Island, etc.), the average rises to 31.2 mm.

Upon passing northward from the Gulf, an increase in size above

32 mm. is found. Thus, 9 skulls from central Alabama, northern Louisiana, and central Arkansas have an average total length of 33.6 mm. It might be expected that this gradual increase would continue as we proceed northward, but such seems not to be the case. On the contrary, there appears to be a sudden increase about on the thirty-sixth parallel, skulls from Tennessee and southeastern Kansas being scarcely inferior in point of size to any in the collection. All over the Ohio and northern Mississippi valleys the largest dimensions prevail, and no correlation between size and geographical location can be traced.

The highest average in size of skulls is found in Illinois, 6 skulls from this State giving 37.3 mm. for average total length. Five skulls from Missouri give 37 mm., and two from Kansas, 36.9 mm. The largest skull in the five collections is one from Warsaw, Illinois (No. 36555 ♂), belonging to the National Museum. This has a total length of 39.8 mm.

The size of a number of these large northern skulls is given in the following table:

Catalogue number.*	Sex.	Locality.	Total length.
			mm.
N. M. 35266	.....	Madisonville, Ohio.....	38.0
Merr. 4264	.....	Eubanks, Ky.....	36.0
D. A. 46496	♂	Big Sandy, Tenn.....	38.6
N. M. 35211	♀	Warsaw, Ill.....	37.6
N. M. 35201	♀	.....do.....	36.5
N. M. 36555	♂	.....do.....	39.8
N. M. 36515	♂	Hamilton, Ill.....	39.0
N. M. 15398	.....	Belleville, Ill.....	36.0
D. A. 64225	.....	Bismarck, Mo.....	36.4
N. M. 1642	.....	St. Louis, Mo.....	35.6
N. M. 1638	.....	.....do.....	38.5
N. M. 1639	.....	.....do.....	37.5
D. A. 54097	.....	Onaga, Kans.....	37.7
D. A. 40407	.....	.....do.....	36.3
D. A. 43761	♀	Council Bluffs, Iowa.....	36.4

* In this table and throughout the paper the following abbreviations are used to denote the several collections examined:

N. M. or U. S. N. M = U. S. National Museum.

D. A. = U. S. Department of Agriculture.

A. M. = American Museum of Natural History, New York.

A. N. S. P. = Academy of Natural Sciences, Philadelphia.

Merr. = Merriam collection.

This large mole is the *machrinus* of Rafinesque, who described a specimen from near Lexington, Kentucky.[1]

The later, but more familiar, name *argentatus* of Audubon and Bachman is a synonym. The type described by these authors is said by them to have been obtained on the prairies of Michigan.[2] It is probable, however, that their specimen really came from northern Ohio, which at one time formed a part of the territory of Michigan. In another connection the authors referred to[3] speak of Erie County, Ohio, as being in Michigan.

[1] Atlantic Journal, 1832, p. 61.

[2] Journ. Acad. Nat. Sci. Phila., VIII, 1842, p. 292.

[3] Loc. cit., VIII, pt. 2, p. 203.

To sum up this discussion regarding size, it may be stated that *Scalops aquaticus* is largest in the northwestern portion of its range and somewhat smaller in the middle Atlantic States, in New York and Pennsylvania. From thence southward it gradually diminishes in size, reaching the extreme in Florida. Along the Gulf coast there is a slight increase, which is lost again in Texas, where the average is practically the same as in Florida. As the Gulf coast is departed from, there is a gradual increase in size, which becomes a sudden one about on the thirty-sixth parallel. Northward the species maintains a maximum size over a wide area.

This discussion of size has purposely been based on the size of the skull, but the size of the whole body furnishes similar indications of average increase and decrease. It is more difficult to determine how far these are illusive in the latter case, on account of the differences in the measurements of fresh specimens, made by different collectors, and the changes produced by the immersion of specimens in alcohol.

As regards color, the New York specimens are perhaps the darkest of the series before me. There is a moderate increase in pallor southward along the Atlantic Coast, but it is far from being pronounced. Specimens from Ohio, Illinois, and the northern Mississippi Valley generally are not perceptibly lighter in color than those from New York. Hence, the name *argentatus* or silvery, as applied to western *Scalops* generally, is misleading. The only quite light-colored specimens from this region, which I have examined, are two from Elk River, Minnesota, one from Council Bluffs, Iowa, and one from Camp Douglas, Wisconsin. The Minnesota specimens are distinctly silvery, and merit the name *argentatus* much more than specimens from the locality of the type in Ohio; and this is true in a still greater degree of the Wisconsin specimen. In southern Kansas the color is relatively light, and from thence southward into Oklahoma and central Texas there is a strong increase in pallor, which reaches its culmination in Padre Island, Texas, and the vicinity, where the surface color is sometimes a silvery white.

The peculiar orange-red coloration on the heads, wrists, and other parts of some specimens, especially those from the Southwest, will be considered in connection with the discussion of the subspecies which have been proposed, as this peculiarity has been mentioned in the diagnoses.

DISCUSSION OF THE NOMINAL SPECIES AND SUBSPECIES.

Among the important nominal species which I have assembled under the name of *S. aquaticus*, is the *Talpa machrina* of Rafinesque, described in 1832 from specimens from near Lexington, Kentucky. His account of it leaves no doubt that it is the mole of the Mississippi Valley, which has hitherto been recognized under the later name of *argentatus*. He described at the same time another Kentucky mole, under the name

of *Talpa sericea*, but this is quite surely the young of the preceding.[1] The *Scalops argentatus* of Audubon and Bachman[2] was described from a specimen from Erie County, Ohio. The diagnosis given is as follows:

S. Pilis tota longitudine albo plumboque annulatis, fronte mentique albido flavescente.

The annulation here spoken of I believe to be merely that produced by the regular crenulation of the hairs. The light striking on these crenulations produces the effect of alternate whitish and lead-colored rings. This appearance is not more marked in specimens from Ohio than in others. I have never seen any in which there was even an approximation to a truly ringed coloration of the hairs.

As for the color of the forehead and chin mentioned in the diagnosis, it is characteristic of the species as a whole.

In the description of this form the authors refer to its unusually large size, in which they were correct, but their remark that the fur "differs strikingly in color and luster" from that of the common mole, will not bear the test of actual comparison.

The characters which I have given on a preceding page (p. 20) are the only ones which are at all constant, and as these are relative and grade into those of the typical Atlantic Coast form, I follow Dr. Coues[3] in reducing the species to a subspecies. I make it a synonym of *Scalops aquaticus machrinus* (Rafinesque).

It may be remarked that the figure given in Audubon's folio Quad-

[1] Rafinesque's description of these two forms in the rare periodical called the Atlantic Journal is as follows:

"In 1820 I discovered two new moles in Kentucky; one is rather common, and the substitute of the common mole in the gardens. I call it talpa machrina. The other, talpa sericea, is rather scarce. A specimen was in Clifford's museum.

"1. Talpa machrina, Raf. 1820.—Long-nose mole. Fur thick, brown with grayish shades; nose elongate, depressed, naked, and tuberculate; tail one-sixth of whole length white, squared, naked; feet white.

"Total length 7 inches; tail 1¼, but only three-fourths out of the fur. Body thick, covered with soft silky fur one-half inch long, shorter and woolly on the head; nose almost like a probocis, one-half inch longer than the lower jaw, moveable, base white villose, and naked rubicund; feet naked, the anterior broad, rounded flat, with 5 toes thick and subpalmate or coherent, 5 claws nearly equal, large, convex above, flat beneath; posterior feet more slender, claws smaller, longer, and narrow. In woods, gardens, and fields, near Lexington, etc. Raises flexuose burrows of great length.

"Talpa sericea, Raf. 1820.—Silky mole. Fur short, silky, gray, with silvery shades; nose short, obtuse; tail one-fifth of whole length, cylindrical.

"Smaller than the first and more slender, only 5 inches long, body 4, and tail 1. Fur very peculiar, and different from other moles, not being reducible to different directions, but imbricate as in other quadrupeds; remainder as in the first sp. Found in woods near Nicholasville and Harrodsburg." (Atlantic Journal, 1832, p. 61.)

[2] Jour. Acad. Nat. Sci., Phila., VIII, pt. 2, 1842, p. 292 (original description.).

[3] Bull. U. S. Geol. and Geog. Survey, 1877, p. 633.

rupeds of North America[1] does not differ in color from ordinary specimens of *S. aquaticus* from New York.

Within recent years three forms of *Scalops* have been described. These are the *S. aquaticus australis* of Chapman,[2] the *S. parvus* of Rhoads,[3] and the *S. texanus* of Dr. J. A. Allen.[4] Dr. Allen's species is from the coast of Texas and the other forms are from Florida. I have not been able to determine the relationship of these forms to my entire satisfaction, chiefly owing to a lack of specimens from the southern portion of the Gulf States.

Mr. Chapman's Florida form *australis* was first described. His diagnosis includes but two characters, thus: "Similar to *Scalops aquaticus*, but averaging slightly browner and constantly much smaller."[2]

I have examined the type and several other skins and alcoholic specimens from the type locality (Gainesville) and other parts of eastern Florida. While the small size of the adults as compared with specimens from farther north on the Atlantic Coast is conspicuous, the difference in shade of color is scarcely perceptible. As regards size, I have shown in another place (p. 29) that there is a gradual diminution on the Atlantic Coast from north to south.

The skull of *australis* when first examined, seems very different from the typical form, on account of its small size and delicate structure. Perhaps the most noticeable feature is the form of the coronoid process of the mandible. This presents a real difference from that found in New York and Pennsylvania specimens. In this latter the coronoid is heavy and not strongly uncinate, and has a supplementary mammiform process on the posterior margin below the extremity. In Florida specimens the coronoid is slender and strongly uncinate and the secondary process is wanting. There is, however, a gradation in this character. In Maryland and Virginia about as many mandibles have the secondary process as are without it, and in the Carolinas it is quite rarely present.

From Mr. Chapman's comparative measurements (though he does not refer to the fact), it would appear that the hind foot is proportionately shorter in *australis* than in typical *aquaticus*.

Very careful measurements of some alcoholic specimens of adults, however, convince that the reverse is the truth, i. e., that the Florida form has the longer foot relatively, though it is, of course, absolutely shorter. The following table brings out this fact and some others in connection with proportions. I chose the proportion of the head to the tail and foot after many trials, and believe it to be reliable.

[1] Plate 150.

[2] Bull. Amer. Mus. Nat. Hist., V, 1893, p. 339.

[3] Proc. Acad. Nat. Sci. Phila, 1894. p. 157.

[4] Bull. Amer. Mus. Nat. Hist., III, 1891, p. 221.

SCALOPS AQUATICUS.

Averages and proportions (alcoholics).

No. of skulls.	Locality.	Head (average).	Tail.		Hind foot.	
			Average.	Proportion.	Average.	Proportion.
		mm.	*mm.*	*Per ct.*	*mm.*	*Per cent.*
5	Illinois and Indiana	49.2	31.2	63.4	19.8	40.0
9	District of Columbia and Virginia	45.6	26.6	58.3	16.5	36.2
8	North Carolina and South Carolina	43.0	24.2	56.3	15.8	36.7
5	Florida (east)	40.1	23.4	58.4	15.1	37.7

Some specimens of the subspecies *australis* exhibit quite strongly the rusty suffusion about the wrists, etc., which, as will presently be shown, is very pronounced in specimens from southern Texas.

The Florida *australis*, as I view the matter, is the extreme so far as the Atlantic Coast is concerned of that diminution in size and increase in delicacy of structure which one finds in passing southward from New York and Pennsylvania.

Another Florida form has been recently described by Mr. Rhoads, under the name of *Scalops parvus*.[1] It is based on a single specimen from Tarpon Springs, a locality on the west coast, just north of Tampa. It is in good condition, but the appearance of the skin and the peculiar worn state of the teeth would seem to indicate that the mole had been kept in confinement. The measurements given by Mr. Rhoads are evidently a misprint.

Of the series of external and cranial characters given by Mr. Rhoads, there are none which are not found in Carolina and central Florida specimens, except the oval shape of the foramen magnum, and this also is approached in some. The peculiar form of the last lower molar would seem to be a strong distinguishing character, but I am satisfied that it is due to the wearing away of the tooth. An examination of a series of specimens from the vicinity of Tampa Bay may confirm the validity of *S. parvus*, but on the basis of the type alone I am unable to regard it as a distinct species. I have placed it with a query under *S. aquaticus australis*.[2]

A specimen from Orange Hammock, Kissimmee River, De Soto County, Florida, which is a locality nearer to Tampa Bay than any from which specimens have yet been obtained, is like Gainesville specimens, but is a little smaller and is also grayer. The *foramen magnum* is of the usual form. The gray coloration may be due to the fact that the specimen was in alcohol for some three months.

The relation of the Florida form to those of the Gulf States is

[1] Proc. Acad. Nat. Sci. Phila., 1894, p. 157.

[2] I have examined a skull from Biloxi, Miss. (No. 7268, alc., U. S. N. M.), which may compel me to alter this opinion. It has a very small oval *foramen magnum*, and the tail in the alcoholic skin is very short. The skull has the remarkable peculiarity of having no anterior lower incisors.

important, because Dr. J. A. Allen has described as different a form said to be from Presidio County, Texas, but probably Aransas County, under the name of *S. texanus*.[1] Dr. Allen first made this a subspecies of "*argentatus*," but later established it as a distinct species.

The type is, unfortunately, a very much worn and discolored specimen, which, like the type of *S. parvus*, presents the appearance of having been kept in confinement. The description of the color given in the original diagnosis is, therefore, of comparatively little value. A series of winter specimens from Aransas County, belonging to the American Museum, do not differ at all as regards coloration from winter specimens from Florida, except in the occasional increased intensity of the rusty orange suffusion on the forehead, wrists, etc. A June specimen from Texas, however, is paler than late spring specimens from Gainesville, Florida. None of the skins in the Aransas County series show the degree of pallor found in a September specimen near Santa Rosa, Cameron County. One from Padre Island is also much paler, and this and another from the same place show an extremely strong rusty suffusion.

In referring to the Texas form since the publication of the original description, Dr. Allen has not brought forward any additional characters, but lays stress[2] on the rusty suffusion. In this he is entirely justified. No other specimens show this peculiarity as do the Texas ones. On the other hand, however, Florida specimens and others from further north, e. g., from North and South Carolina and Maryland, exhibit it to a greater or less degree. It seems to be a characteristic of adult or old males. The females show it but little and the young not at all.[3]

Langdon remarks on this peculiarity in connection with the subspecies *machrinus* in Ohio:

> Specimens showing orange-colored spots or streaks on the ventral surface and about the mouth are of somewhat frequent occurrence. (Journ. Cincinn. Soc. Nat. Hist., III, 1880, p. 302.)

There is practically no difference in size between *texanus* and *australis*, so far as can be judged from the length of the skull. The average total length of 7 adult skulls from Rockport is 30.9 mm., and of 5 adult skulls from Florida, 31 mm. The Texas skulls differ from the Florida ones, however, in a number of details, and to this I shall refer again presently. From the intermediate region I have only two adult skulls for comparison. One from Grand Coteau, Louisiana, has a total length of 32.5 mm., and one from Biloxi, Mississippi (both localities near the coast), 31 mm.

Taking the seven specimens of *texanus*, in which the skulls have an average total length of 30.9 mm., I find that the hind foot, without the claw (measured on the dry skins), has an average length of 15.4 mm.

[1] Bull. Amer. Mus. Nat. Hist., III, 1891, p. 221.

[2] Bull. Amer. Mus. Nat. Hist., V, 1893, p. 200.

[3] For further remarks on this rusty suffusion see p. 31.

In the only two specimens of *australis* which can be used for comparison (the type and another) the skull is 31 mm. long, and the hind foot has a length of 15 mm. and 15.4 mm. respectively. It would seem probable from this that there is no appreciable difference in the relative length of the hind foot in these two forms. As somewhat confirming this opinion, I find that the average measurements of eight females of *texanus* (measured when fresh) recently given by Dr. Allen agree very closely with average measurements of seven fresh specimens (females also) in the National Museum collection from Raleigh, North Carolina. In the former, the hind foot 12.3 per cent of the total length, and in the latter 12.4 per cent.

In opposition to these apparently close resemblances in proportions, we find that the tail is much longer in *texanus* than in *australis*, being about 18 per cent of the total length in males of the former variety and 13 per cent in the latter. The skull of *texanus*, as already mentioned differs in some respects from that of *australis*. Very striking in the former is the enlargement of the muzzle and the massiveness of the coronoid process of the mandible. This process has generally a straight posterior margin in *texanus*, but a concave one in *australis*. Further, the molar teeth in *texanus* are relatively larger and more nearly square in outline, and the first upper premolar is very small.

On account of the large size of the molars, the mandible is heavier and deeper than in the Florida mole.

These peculiarities of the teeth and skull appear to me to connect the Texas mole with the large Mississippi Valley *machrinus*, and I am disposed to regard the form as connected with typical *aquaticus* through that channel. Whether *texanus* is connected also with *australis* appears to me more uncertain. Specimens from about New Orleans, however, exhibit characters intermediate between *australis* and *texanus*. Thus, in specimens from Louisiana and Mississippi, the molar teeth are moderately large and the upper premolar is neither very large nor very small. Such specimens as are at hand, however, do not show the rusty suffusion in any striking manner; indeed, not as much so as specimens from Florida, the Carolinas, and elsewhere. The material at command is scarcely sufficient for a determination of the questions at issue, and conjectures in this case will be of little value.[1]

[1] After the foregoing paragraphs were in type I had the opportunity, as already stated, of examining Mr. Bangs' interesting collection, which contains five specimens from Mer Rouge, Louisiana, and an excellent series of adults from Oak Grove, Florida. An examination of the skulls of the Florida series makes it more evident that in cranial characters, as in size, *australis* very closely resembles *texanus*, the greater breadth of the muzzle in the latter being perhaps the only difference of any magnitude and constancy.

The Louisiana specimens are rather puzzling, but they have the long tail and broad muzzle of *texanus*. The skulls are larger than typical *texanus*, as might be expected. Two skins exhibit the rusty suffusion on the breast very strongly. Three adults, measured when fresh, give average dimensions as follows: Total length, 157.7 mm.; tail, 30 mm.; hind foot, 20.7 mm.

Northern Louisiana appears to be a region of intergrades of typical *aquaticus* from around the southern extremity of the Alleghanies, *texanus* from the southwest, and *machrinus* from the north.

SEASONAL CHANGES OF PELAGE.

The winter fur in *Scalops* is longer and grayer in color than the summer fur.

The males of this species in the northern part of the range shed the winter fur in May and the summer fur in October. The females commonly undergo the changes during the same months, but the process is frequently retarded in spring from causes connected apparently with reproduction. Thus a female from the Central Park, New York (Amer. Mus. Coll., 1610), obtained July 12, presents the worn winter pelage, with the spring pelage concealed beneath it. Another female (Merr. Coll., 2750) from Laurel, Maryland, obtained June 23, has the long winter fur on the middle of the back, while the rump and shoulders are clothed with the shorter fresh spring fur. In still another specimen, an adult female from Washington City (Dept. Agric. Coll., 22858), obtained July 1, though the long winter fur has been shed from the greater part of the back, it still remains on the anterior portion.

The time of the spring change appears to vary considerably with the latitude, and specimens from the Northern States begin to shed later in spring than those from the South. A nursing female from Oak Lodge, Florida, in Mr. Bangs' collection, obtained February 21, has new fur on the lower surfaces, except a narrow band across the abdomen. There is certainly no retardation in this case. A male from the same locality, taken February 26, apparently has new fur on the shoulders.

Two fall specimens (males) from Padre Island, Texas, taken November 6 and 9, have not completed the molt. Hence it may be supposed that the fall change is somewhat delayed at the South.

The winter fur, as already intimated, is much longer than the summer fur and darker in color.

INDIVIDUAL VARIATIONS IN DENTITION AND COLORATION.

A considerable number of the skulls of *Scalops* which I have examined possess greater or less abnormalities of dentition. These usually consist in the retention or suppression of teeth which are normally absent or present respectively. One of the most striking of these deviations is the presence of an extra lower premolar in front of the usual ones. In two cases of adult skulls which have come under my observation this tooth is present on both sides, and in another instance on one side only. In one of the skulls this extra tooth is large and prominent, but in the others it is filiform. It is perhaps doubtful whether this should be regarded as an abnormality. In all the quite young skulls which I have examined, this tooth is present usually on both sides of the jaw. I have been unable to detect any milk tooth corresponding to this small extra tooth, but as this would in any case be extremely minute it has probably escaped my scrutiny. It may be remarked further in this connection that many jaws in which this tooth can not be detected exhibit at the point where it should occur a small

depression or an irregularity of the structure of the bone which would lead one to suspect that a careful histological study of the region might bring a rudiment of the tooth to light in many instances.

The most common cases of suppression of teeth are those in which one or both of the filiform second and third upper incisors are absent. In many cases the absence of these teeth is probably due to ordinary wear, but in other cases they appear to have been absent from the start. Some eight or nine such cases have come under my observation. A very singular abnormality in a skull from Mississippi (skin No. 7268 N. M.) is the absence of the first lower incisor on both sides. In five cases I have found the first upper premolar lacking either on one side or on both sides.

None of these abnormalities can be correlated with geographical distribution, but occur sporadically in different parts of the country. In no case where I have been able to examine two or more skulls from one locality have I found the same abnormality repeated.[1]

There is a considerable amount of abnormality in coloration in the genus, but it may be said that it always takes the form of complete or partial albinism unless the presence of a rusty suffusion may be

[1] DENTAL VARIATIONS IN SPECIMENS OF SCALOPS AQUATICUS EXAMINED.

A. N. S. P. 3532. Woodville, Alabama.
Lacks first upper premolar on each side and also second upper incisor on each side. (Does not differ otherwise, so far as I can see. Head skin has large white blotch under right arm.)

D. A. 51386.
Lacks I^{2} on both sides. Probably fallen out, as teeth are all much worn.

N. M. 4853. Carlisle, Pennsylvania.
Lacks I^{2} on both sides and PM^{1} on left side. There are depressions, however, and the teeth have *very* probably dropped out. All the teeth much worn.

N. M. 1142. Washington, Mississippi.
I^{3} very large. (Skull looks narrow.)

N. M. 955. Carlisle, Pennsylvania.
Has an I_{3} on each side. Small, but very distinct.

N. M. 35292. North Carolina.
Lacks PM^{1} right side. Evidently deciduous.

N. M. 3922. Georgia?
Right I^{2} and I^{3} and left I^{2} wanting. Those of the right side seem to be merely worn down to the gum. The lower jaw has a trace of an $I_{?}$ on each side in the gum.

N. M. 1638. St. Louis, Missouri.
Left I^{2} and I^{3} and right I^{2} wanting. All teeth much worn.

A. M. 4489. Rockport, Texas.
Only a trace of I^{2} and I^{3} left side and I^{2} right side.

A. M. 4485. Rockport, Texas.
Only a trace of I^{2} and I^{3} both sides.

A. M. 895. Raleigh, North Carolina.
I^{2} and I^{3} left side and I^{2} right, wanting. Evidently deciduous.

A. M. 1002. Raleigh, North Carolina.
Has a small $I_{?}$ on left side.

regarded as an abnormality also. I have examined three albino moles of the genus *Scalops*, one each from Georgia, Alabama, and Louisiana.

In the Alabama specimen, which is the only well preserved dry skin, the hair is dull white at the base, then a very delicate tint of orange-tawny and cream-white at the tips. On the head and the lower surfaces the orange tint is considerably stronger.

A large individual from Ohio has the under surfaces and the head and shoulders pure white, but the white area is irregular and occupies more of the right side than the left. A young specimen from Florida has pure white hair on the left side of the breast and around the wrist and a band of the same color extends over the left shoulder. Several specimens which I have examined have white patches of small extent about the mouth, nose, and feet.

CHARACTERISTICS OF YOUNG MOLES.

Though I have never seen fresh specimens of very young moles, I surmise that they must present a very singular appearance. The fur is short and appressed and of a silvery color, and lighter than that of adults. The tail is relatively long, and the claws are long and acutely pointed, especially those of the hind feet. The fore feet are relatively large.

D. A. 30419. Highland, Maryland.
Left $I\frac{2}{2}$ and $I\frac{3}{3}$ wanting.

D. A. 33102. Raleigh, North Carolina.
Left $I\frac{2}{2}$ wanting.

D. A. 30426. Washington City.
Left and right $I\frac{2}{2}$ wanting.

D. A. 57029. Greensboro, Alabama.
Wants right PM $\frac{1}{1}$ and $I\frac{2}{2}$ on both sides.

N. M. 1611. St. Louis, Missouri.
Has $I\frac{2}{2}$ larger than $I\frac{2}{2}$.

N. M. 1642. St. Louis, Missouri.
Evidently same as preceding on right side; on left $I\frac{2}{2}$ is entirely lacking, with no trace.

N. M. 1639. St. Louis, Missouri.
Ditto as regards size of $I\frac{3}{3}$.

N. M. 35202. Illinois?
Left $I\frac{2}{2}$ deciduous.

N. M. 35200. Warsaw, Illinois.
$I\frac{3}{3}$ considerably larger than $I\frac{2}{2}$.

N. M. 35203. Warsaw, Illinois.
$I\frac{2}{2}$ and $I\frac{2}{2}$ both sides gone. A very slight depression the only trace of them.

N. M. 7269. Fairfield County, Ohio.
Has very distinct $I\frac{1}{1}$ on each side. Left PM $\frac{1}{1}$ is absent. (This is a very large specimen with mottled white and gray fur.)

N. M. 1640. St. Louis, Missouri.
$I\frac{2}{2}$ wanting on both sides.

N. M. 1141. Charleston, South Carolina.
Has a small but distinct $I\frac{3}{3}$ on both sides.

D. A. 51386. Rockport, Texas.
$I\frac{2}{2}$ and $I\frac{2}{2}$ on both sides wanting.

HISTORY OF THE SPECIES.

This species occurs in the tenth edition of Linnæus's Systema Naturæ[1] under the name of *Sorex aquaticus*. The diagnosis and description given are quite accurate and there is no doubt as to the species intended. The only synonym, however, is *Talpa, Virginianus, niger*, Seba,[2] which, though cited here and for many years after as an equivalent of *S. aquaticus*, I find to be identical with *Talpa europæa*. As Seba gives an excellent figure of his species, there can be no doubt as to its identity, though why he did not recognize that it was the European mole, is not readily explainable.[3]

As authority in regard to the habitat of his *Sorex aquaticus*, Linnæus cites P. Kalm. Kalm saw the burrows of the mole on the shores of the Schuylkill River at Philadelphia.[4] He remarks on the strength and other characteristics of one captured (probably at some subsequent time), but does not describe it in detail, saying that he intends to do so in another work.[5]

Kerr, in his English edition of Linnæus's Systema Naturæ,[6] published in 1792, introduces an American species, under the name of *Talpa fusca* or the Brown Mole. This is based primarily on the Brown Mole of Pennant, although *Sorex aquaticus*, Linn., and also the *Talpa, Virginianus, niger* of Seba, are quoted as synonyms.[7] Pennant's "Brown Mole" is in turn Linnæus's *Sorex aquaticus*.[8] Pennant's specimens were from New York, whence he obtained his Yellow Mole and also his Radiated[9] and Long-tailed Moles.[9] He mentions especially in this con-

[1] Page 53.

[2] Mus., I, p. 51, pl. 32, fig. 3.

[3] Erxleben seems to have suspected that such was the case. He quotes Seba's name under *Sorex aquaticus*, with a mark of interrogation, and adds "videtus potius varietas Talpae europeae" (Syst. Regn. Anim., 1777, p. 123). Shaw was struck by the resemblance between Seba's species and the European mole, but it did not occur to him to doubt the correctness of the locality given by Seba. He writes as follows: "This species so completely resembles the common European mole in almost every particular, that it might pass for a variety of that animal. * * * It seems to have been first described by Seba, and is, according to that author, a native of Virginia" (Gen. Zoology, I, pt. 1, Mam., 1800, p. 521).

Other moles represented on plate 32 of Seba's work have erroneous localities assigned to them, and one figure (fig. 2) appears to be entirely incorrect. It represents a mole like *Talpa europæa*, with fore feet like a *Chrysochloris*.

[4] Kalm's Travels into North America. Forster's English trans., vol. 1, 1770, p. 90. Forster thinks the species here referred to is *Condylura cristata*, which does not seem to me probable.

[5] This intention was never carried into effect, so far as I know.

[6] Kerr, Animal Kingdom, 1792, p. 202.

[7] Probably Kerr did not propose to establish a new species. He writes: "This and the Crested species, though placed in the Systema Naturæ among the shrews, have the manners and figure of the mole, etc." He probably considered that he had a right to give a new specific name in transferring the species to the genus *Talpa*.

[8] Pennant, Quadrupeds, 3d edition, 1793, p. 232. I have not the first edition.

[9] Equivalent to *Condylura cristata*.

nection that he did not obtain specimens of Seba's *Talpa, Virginianus, niger*, which, of course, was quite natural, as that species is really *Talpa europæa.*

Pennant's "Yellow Mole"[1] became *Talpa europæa flavescens* at the hands of Erxleben,[2] who merely translated the English description into Latin, but adds Seba's *Talpa, Virginianus, niger*, with an interrogation, as a synonym.

Schreber mentions Pennant's "Yellow Mole" under the name of "Der gelbe Maulwurf," but does not give it a Latin designation. He also includes in his summary "Der rothe Maulwurf," which is Seba's "Talpa, rubra, Americana."[3] Under the genus *Sorex* he has "Der Weiss-schwanz. Tab. CLVIII. *Sorex aquaticus* Linn.," citing Seba's "*Talpa, Virginianus, niger*," and Pennant's "Brown Mole," as synonyms.[4]

Gmelin cites Pennant's "Yellow Mole," and gives to the form the name of *Talpa europæa flava.*[5] In 1792 Kerr shortened this name to *Talpa flava.*[6]

Shaw, whose "General Zoology" appeared in 1800, has two American species of moles, besides those referable to *Condylura cristata.* These are the "Purple Mole" and the "Brown Mole." The "Purple Mole, *Talpa purpurascens*," is based on Seba's *Talpa, Virginianus, niger*, and is therefore equivalent to *Talpa europæa* (see p. 40).[7] The "Brown Mole, *Talpa fusca*,"[8] like Kerr's species of the same name, is based on Pennant's "Brown Mole," which, as already stated, is equivalent to Linnæus's *Sorex aquaticus.* Shaw employs this last as a synonym, with a mark of interrogation, and says:

> If this species be the same with the *Sorex aquaticus* of Linnæus, it has, according to that author, webbed fore feet, and, from its name, should seem to inhabit watery places; but neither of these circumstances are mentioned by Mr. Pennant.

In 1820 Desmarest introduced the name *Scalops canadensis* for our species,[9] though for what reason does not appear, unless employed as a translation of Cuvier's "Scalope du Canada."[10] In this he was followed by Godman in 1831.[11]

Harlan's *Scalops pennsylvanica*[12] appears to be the present species. This form was supposed by Harlan to differ from *Scalops aquaticus* in

[1] Quadrupeds, 1771, p. 312 (*fide* Baird); ditto. 3d ed., II, 1793, p. 230. Really given as a variety of the European mole.

[2] Syst. Regn. Anim., 1777, p. 118.

[3] Säugethiere, III, 1778, pp. 559 and 561.

[4] Loc. cit., p. 566.

[5] Gmelin, Linn. Syst. Nat., 13th ed., 1788, p. 110.

[6] Kerr, Anim. Kingdom, 1792, p. 201.

[7] Shaw, Gen. Zool., I, pt. 1, Mam., 1800, p. 521.

[8] Loc. cit., p. 524.

[9] Mammalogie, pt. 1, 1820, p. 155.

[10] Règne Anim., 1st ed., I, 1817, p. 135.

[11] Amer. Nat. Hist., I, 1831, p. 84.

[12] Fauna Americana, 1825, p. 33.

the form of its molar teeth, but, as his description of them agrees with the latter species, it is supposable that he was misled by the descriptions of F. Cuvier and Desmarest. He gives the whole number of teeth as 40, or 4 in excess of the proper number. This was due to the addition of 4 "false molar" teeth to the dental formula, an error which probably crept in unintentionally, as he states in another place that "this species corresponds in the number and arrangement of its teeth with the genus *Scalops* of F. Cuvier." The type (a skeleton) was presumably from Pennsylvania.

The error in the dental formula of Harlan's *Scalops pennsylvanica* led Lesson, in 1827, to establish the genus *Talpasorex* for the reception of the species.[1]

The first reference to the common mole, under the name now used, appears to be that in F. Cuvier's work on the teeth of mammals, published in 1825.[2] This is not quite in the regular form, as he gives merely the name of the genus *Scalops* in his systematic index, and under it "Scalope aquatique, *sorex aquaticus*, Linn."

The intention, however, was clearly to name the species *Scalops aquaticus*, but this was not formally done, so far as I have been able to ascertain, until 1829, when it occurs in Fischer's Synopsis Mammalium.[3]

In 1842 Bachman published an admirable revision of the American moles,[4] in which he cleared up the synonymy of the species under consideration, and corrected many misapprehensions prevailing at that time.

In 1853 Dr. John L. LeConte attempted a revision of the American moles on the basis of specimens in the museum of the Philadelphia Academy.[5]

He considered that the genus *Scalops* was not well founded, and returned all the species to the genus *Talpa*, which he then proceeded to divide into sections. These sections, one, two, and three, cover quite exactly the genera *Talpa*, *Scapanus*, and *Scalops*, respectively, as they were currently adopted. With the first section, of which the type was *Talpa europæa*, we have no concern. The second section contained *Talpa breweri*, *Talpa aurea*, *Talpa townsendii*, and *Talpa tæniata*. *Talpa breweri* is the species recognized in this work as *Parascalops breweri* (Bachman), and the other species are supposed to be identical with *Scapanus townsendi*, as will be more fully stated when considering that genus.

The third section contains, besides *Scalops aquaticus*, a species called *Talpa pennantii*, which, as LeConte states, "appears to be the yellow mole of Pennant."[6] It is not based on this, however, but on a specimen

[1] Lesson, Manuel de Mammalogie, 1827, p. 121.

[2] F. Cuvier, Dents des Mammifères, 1825, p. 251.

[3] Page 249.

[4] Boston Journ. Nat. Hist., IV, 1842, p. 26.

[5] Proc. Acad. Nat. Sci. Phila., VI, 1853, p. 326.

[6] If Pennant's "yellow mole" were a valid species, LeConte's name would, of course, have no standing, as the former received a Latin appellation long before LeConte's paper appeared.

in the Philadelphia Academy Museum, which, from its large size and other characters, would seem to be the same as *Scalops aquaticus argentatus*. The description is far from satisfactory.

LeConte refers in the paper under consideration to the *Talpa cupreata* of Rafinesque, which, he says, is "unknown in recent times." So far as may be judged from Rafinesque's diagnosis, the name should be considered a synonym of typical *Scalops aquaticus*. The tail, however, is short ("le septième de la longueur"), which may possibly indicate that Rafinesque's specimen was from Florida,[1] and represented the subspecies *australis*. This is unlikely, however, as in a reference to it subsequent to the original description he remarks that it was "one of the moles found in the Atlantic States."[2]

DESCRIPTION OF THE TYPE SPECIMEN OF SCALOPS PARVUS, RHOADS.

No. 1168. Male. Tarpon Springs, Florida, December 24, 1893. (Rhoads collection.) Collector's measurements: "L., 4.60; T., 0.60; H. ft.(?), 0.73."

This is probably an adult, but the great wearing of the teeth would appear to be due to its having been kept in confinement. All the sutures are closed and there is a small crest. (The left zygomatic arch and coronoid are broken.)

The skin measures 0.113 mm. from tip of snout to base of tail; tail, without hairs, 16 mm.; hind foot and claw, 16.5 mm.; hind foot, without claw, 14 mm.

General color silvery brown. The wrists, the region of the eyes, and two spots on the breast are rust-colored.

The front claws have upon them a deposit of quartz grains united by a black pasty material.

Dimensions of the type skull.

	mm.
Greatest length	29.5
Basilar length (Hensel)	24.0
Mastoid breadth	15.3
Greatest zygomatic breadth	13.8
Palate length (inside incisors)	12.3
Angle to coronoid of mandible (angle broken)	8.3

[1] Through the kindness of Mr. Howard M. Ballou, of Melrose Highlands, Massachusetts, I am able to quote Rafinesque's diagnosis from the rare work in which it occurs. This is the "Précis des découvertes et travaux somiologiques." Palermo, 1814. The diagnosis, which occurs on p. 14, is as follows: "Talpa cupreata. Queue le septième de la longueur, totale brun luisant argenté, à reflets cuivrés et pourprés, gorge légèrement roussâtre, museau couleur de chair et nu, pieds concolors.—Obs. de l'Amér. septentrionale."

[2] Atlantic Journal, 1832, p. 61.

DESCRIPTION OF THE TYPE SPECIMEN OF SCALOPS AQUATICUS AUSTRALIS, CHAPMAN.

$\frac{3316}{2290}$. Gainesville, Florida, May 4, 1891. F. M. Chapman. (Amer. Mus.)

This is a rather young individual, as shown by the skull, in which the teeth are unworn and the outlines of the nasal bones and even the suture between the premaxillæ and maxillæ are still distinguishable. There is no crest and the occipital and other posterior sutures are open.

The skin measures 99 mm. from tip of snout to base of tail; tail without hairs, 21 mm.; length of fore foot and claws, 19 mm.; width fore foot, 16 mm.; length hind foot and claws, 17 mm.

The general color is silvery brown, which is exactly matched by specimens from farther north, notably No. 22843, D. A., Washington City, which is a little older.

The hairs of the snout, wrists, backs of feet and tail are dull white, without any rusty admixture.

DESCRIPTION OF THE TYPE SPECIMEN OF SCALOPS TEXANUS, J. A. ALLEN.

$\frac{3488}{2740}$. Presidio Co.? Texas. Wm. Lloyd. 1887. (Amer. Mus.)

The skin is in poor condition. The animal appears to have been kept in confinement, as the claws are long and irregular.

The color is dull brown, with an irregular soiled rusty area on the under side of the body, from the jaw to the middle of the belly, and other spots of the same on the belly and sides. There is more of this rusty color about the sides of the head and around the wrists.

The color is similar to that of the Rockport, Texas. series, but is browner, due apparently to the fur being worn and faded. The skin does not show bright orange red spots about the eyes which are present in many of the Rockport specimens, but there is a dull reddish brown in the same situation.

The skin measures as follows:

	mm.
Head and body	100.0
Tail vertebræ	21.0
Fore foot and claw	19.5
Hind foot and claw	17.0

The skull, which is much broken, measures as follows:

	mm.
Length of upper tooth row	14.8
Breadth across palate, between post-external angles of first molars	10.0

Average dimensions of 10 fresh specimens, S. a. typicus (Bangs Coll.).

Locality.	Total Length.	Length of tail.	Length of hind foot.	Breadth of fore foot.
Wareham, Mass. (5)	159.3	26.6	19.5	20.5
Liberty Hill, Conn. (5)	169.0	−29.0	20.0	.....

Dimensions of skulls of Scalops aquaticus typicus.

Catalogue number.		Collection.	Locality.	Sex.	Total length.	Basilar length (Hensel).	Length of palate from inside first incisor.	Mastoid breadth.	Greatest zygomatic breadth.	Breadth between postero-external angles of first molars.	Height of coronoid process.	Age.
Skull.	Skin.				mm.	mm.	mm.	mm.	mm.	mm.	mm.	
3546	.....	Bangs	Wareham, Mass	♂	34.6	28.2	15.4	18.2	15.8	10.0	4.8	Adult.
706	.....	.....do	.....do	♂	34.0	27.6	14.8	17.6	15.6	9.9	4.4	Do.
708	.....	.....do	.....do	♂	35.0	28.2	15.0	18.0	15.8	10.0	4.7	Do.
3544	.....	.....do	.....do	♀	32.5	26.4	14.0	17.5	15.0	9.6	4.0	Do.
705	.....	.....do	.....do	♂	32.5	26.0	14.0	17.5	15.0	9.5	4.0	Do.
704	.....	.....do	Liberty Hill, Conn.	♂	36.0	29.5	15.8	18.6	.....	10.5	4.8	Do.
4276	.....	.....do	.....do	♀	35.8	29.2	15.8	18.4	16.0	9.6	4.2	Do.
701	.....	.....do	.....do	♀	35.0	28.9	15.5	18.2	16.0	9.6	4.6	Do.
702	.....	.....do	.....do	♀	35.2	29.0	15.0	18.5	16.0	10.4	4.8	Do.
703	.....	.....do	.....do	♀	35.0	28.9	15.2	18.4	16.0	10.3	5.0	Do.
2478	3184	Amer. Mus.	Tarrytown Heights, N. Y.		.....	.....	15.8	.....	.....	10.9	.....	Youngish.
2479	3185	.....do	Tarrytown Heights, N. Y.		.....	.....	16.2	.....	.....	.....	4.0	
1537	2539	.....do	Dunwoodie, N. Y....		33.5	28.0	14.7	17.5	15.3	9.7	3.3	Adult, or less.
1207	.....	Merriam....	Sing Sing, N. Y.....		33.4	27.7	15.0	17.2	15.0	9.2	4.0	Adult.
1206	.....	.....do	.....do	♂	36.0	29.6	15.8	18.3	15.8	10.1	3.9	Do.
1790	1129	.....do	.....do		34.5	28.5	15.0	17.6	15.0	.....	4.5	Do.
793	1594	Amer. Mus.	Hastings, N. Y.....	♀	.....	.....	15.4	18.5	.....	9.4	.....	
809	1610	.....do	Central Park, N. Y..	♀	36.0	29.8	16.0	17.9	.....	10.0	4.4	Adult, or less.
2274	2850	.....do	Englewood, N. J....		36.8	30.0	16.1	19.0	16.0	9.8	4.5	Adult, or less.
588	.....	Nat. Mus....	Carlisle, Pa		35.4	29.0	15.7	17.7	15.8	9.4	4.0	Youngish.
4852	.....	.....do	.....do		35.0	29.0	15.0	17.7	15.5	9.7	4.0	Do.
4853	.....	.....do	.....do		34.8	28.6	15.0	18.2	16.0	9.7	3.7	
4851	.....	.....do	.....do		34.4	28.9	15.0	18.0	15.5	9.7	4.0	
35060	.....	.....do	Baltimore, Md		33.8	28.0	14.5	17.5	15.5	9.8	.....	
30419	.....	Dept. Agric.	Highland, Md	♂	35.4	29.8	15.5	.....	.....	9.8	3.8	
3389	.....	Merriam....	Laurel, Md	♂	34.2	28.6	15.0	17.8	.....	9.6	3.4	Young.
3387	2750	.....do	.....do	♀	33.6	28.2	15.0	17.2	15.1	9.3	3.3	Youngish.
3388	2751	.....do	.....do	♀	32.3	26.6	14.0	16.5	.....	9.0	3.5	Do.
35072	19370	Nat. Mus....	Baltimore, Md	♀	32.4	27.4	14.4	17.3	15.0	9.4	4.0	Adult.
30206	22843	Dept. Agric.	Washington, D. C ..	♀	34.8	29.0	15.1	17.6	15.0	9.6	3.4	
30303	22850	.....do	.....do	♀	.....	.....	14.6	17.5	15.0	9.4	3.2	
30297	22844	.....do	.....do	♂	34.2	29.0	15.2	17.8	15.6	9.7	3.4	
30311	22858	.....do	.....do	♀	33.5	28.2	14.8	17.6	14.9	9.2	3.4	Do.
30426	.....	.....do	.....do	♂	32.6	27.0	14.3	16.7	14.6	9.0	3.2	
59607	.....	Nat. Mus....	Brightwood, D. C....	♂	33.0	27.5	14.3	17.9	15.6	9.4	4.0	Do.
1935	754	.....do	District of Columbia		33.8	27.8	14.6	16.8	14.6	9.2	....	
23114	16317	.....do	Ballston, Va.....		.....	.....	14.6	.....	.....	9.6	3.8	
1140	158	.....do	Clarke County, Va.		34.4	28.8	15.3	17.8	15.4	9.0	3.9	
668	1444	Amer. Mus.	Raleigh, N. C.....	♀	33.0	27.0	14.3	17.0	14.5	9.3	3.1	Youngish.
2796	.....	Merriam.....	.....do	♂	33.0	27.4	13.8	17.2	14.7	8.7	3.9	Adult.
936	1258	Amer. Mus.	.....do	♂	32.8	27.6	14.3	17.0	15.0	9.0	3.6	Do.
895	1717	.....do	.....do		32.2	26.0	14.0	.....	14.3	8.6	.....	Do.
33173	25767	Dept. Agric.	.....do	♀	32.0	26.0	13.6	16.7	14.2	8.8	3.6	Do.
33175	25769	.....do	.....do	♀	31.8	25.9	13.6	16.3	14.3	8.5	3.3	
33174	25768	.....do	.....do	♀	31.6	25.9	13.2	16.6	14.2	8.6	4.2	
894	1716	Amer. Mus.	.....do	♂	31.5	25.7	13.2	16.4	14.0	8.8	3.4	Do.
33172	25766	Dept. Agric.	.....do	♀	31.2	25.8	13.2	16.5	14.2	8.6	.....	
669	1445	Amer. Mus.	.....do	♀	31.0	26.0	13.3	15.8	13.8	8.4	4.0	Youngish.
1002	1137	.....do	.....do	♀	31.0	25.7	14.1	16.3	14.3	8.8	3.8	Adult, or less.
2361	3048	.....do	Asheville, N. C		32.0	27.0	14.0	17.3	15.0	9.6	3.7	
2801	2291	Merriam....	Highlands, N. C.....	♀	33.0	27.6	14.5	17.7	.....	9.5	4.2	Adult.
54748	.....	Dept. Agric.	Roan Mountain (3,500 ft.), N. C.	♂	36.0	30.1	16.0	18.6	16.6	.....	4.4	Do.
35292	19854	Nat. Mus....	Raleigh, (?) N. C....		31.4	25.8	13.3	16.6	.....	8.6	3.9	Do.
508	1079	Amer. Mus.	Frogmore, S. C.....	♂	.....	.....	13.7	16.6	14.5	8.6	4.0	Young.
35272	19792	Nat. Mus....	.....do	♂	33.2	27.0	14.6	17.5	.....	9.5	3.7	Adult.
1505	.....	Merriam.....	.....do		33.8	28.0	14.6	17.4	15.8	9.3	3.7	Adult, or less.
1440	.....	.....do	.....do	♂	33.6	27.2	14.2	17.4	15.5	9.1	.....	Adult, or less.
1525	923	.....do	.....do		32.5	27.0	14.2	17.0	15.0	9.4	3.5	Adult.
1141	.....	Nat. Mus....	Charleston, S. C		32.2	26.4	13.4	16.8	.....	9.0	3.9	

Dimensions of skulls of Scalops aquaticus australis.

Catalogue number.		Collection.	Locality.	Sex.	Total length.	Basilar length (Henseel).	Length of palate from inside first incisor.	Mastoid breadth.	Greatest zygomatic breadth.	Breadth between postero-external angles of first molars.	Height of coronoid process.	Age.
Skull.	Skin.				mm.	mm.	mm.	mm.	mm.	mm.	mm.	
1130	1858	Amer. Mus.	Gainesville, Fla	♀	31.0	25.2	13.2	16.4	14.2	9.6	3.7	Adult.
3461	.....	Bangs	Oak Lodge, Fla.	♂	30.5	26.0	13.0	16.4	14.5	8.8	4.0	Do.
3462	.....	.....do	.....do	♂	31.0	26.0	13.2	16.0	14.4	8.8	4.0	Do.
3463	.....	.....do	.....do	♂	30.0	25.0	13.3	15.8	13.8	8.2	3.8	Do.
3464	.....	.....do	.....do	♂	31.0	25.5	13.0	16.6	.....	9.0	4.0	Do.
3465	.....	.....do	.....do	♂	31.0	25.8	13.0	16.0	.....	9.0	4.0	Do.
3468	.....	.....do	.....do	♂	30.5	24.5	13.0	16.4	14.5	9.0	4.0	Do.
3469	.....	.....do	.....do	♂	31.0	25.0	13.2	16.0	14.2	8.2	4.0	Do.
3470	.....	.....do	.....do	♂	30.5	24.8	12.8	16.0	14.0	9.0	4.0	Do.
3471	.....	.....do	.....do	♀	30.6	26.0	13.2	16.5	14.5	8.5	4.0	Do.
3467	.....	.....do	.....do	♀	30.0	25.0	13.0	15.5	13.5	8.2	3.8	Do.
3468	.....	.....do	.....do	♀	30.2	25.5	13.0	16.2	14.4	9.0	4.0	Do.
23510	16579	Dept. Agric.	Hypoluxo and Lake Worth, Fla.	...	27.8	23.2	11.3	.....	.....	7.8	3.2	Do.
63359	.....	Nat. Mus ...	Orange Hammock, De Soto County, Fla.	♂	30.0	24.2	12.4	16.0	14.0	9.0	3.3	Adolescent.
	7268	.....do	Biloxi, Miss	...	31.0	25.6	13.4	16.3	14.1	8.6	3.7	Do.
36935	4841	.....do	New Orleans, La....	...	32.7	27.2	14.4	16.2	14.2	8.3	3.8	Youngish.

Dimensions of skulls of Scalops aquaticus machrinus.

					mm.	mm.	mm.	mm.	mm.	mm.	mm.	
7269	.....	Nat. Mus ...	Fairfield County, Ohio.	...	.....	.....	17.2	.....	.....	11.2	4.3	
35666	13843	.....do	Madisonville, Ohio	...	38.0	31.2	16.6	19.8	17.2	11.0	.....	Old.
4264	3654	Merriam.....	Eubanks, Ky.....	...	36.0	30.3	16.1	18.6	16.1	10.8	3.8	Youngish.
46496	34411	Dept. Agric.	Big Sandy, Tenn ..	♂	38.6	32.3	17.0	20.6	17.7	10.8	4.0	Adult, or less.
36515	21813	Nat. Mus ...	Hamilton, Ill	♂	39.0	32.8	17.6	20.3	18.4	11.4	4.8	Adult.
2616	1029	.....do	Alton, Ill	...	.....	31.0	16.4	18.9	.....	10.5	4.2	Do.
15398	.....	.....do	Belleville, Ill.....	...	36.0	29.2	15.6	19.0	.....	10.4	3.6	
35211	19626	.....do	Warsaw, Ill.....	♀	37.5	31.5	.....	19.6	17.2	.....	4.4	Youngish.
35200	.....	.....do	.....do	...	.....	.....	17.5	.....	.....	.....	4.5	Do.
35201	19616	.....do	.....do	♀	36.5	30.5	16.5	18.7	16.7	10.4	4.5	Adult, or less.
35203	19618	.....do	.....do	♂	35.2	29.0	15.5	19.0	16.4	.....	4.2	Do.
36555	21871	.....do	.....do	♂	39.8	33.4	.....	20.8	.....	10.5	4.0	Adult.
25350	18580	Dept. Agric.	Elk River, Minn...	...	36.2	30.0	15.8	19.3	16.9	10.6	4.4	Do.
53792	.....	.....do	.....do	♀	34.3	.....	.....	.....	.....	.....	.....	
1831	.....	Amer. Mus .	Fort Snelling, Minn	♀	36.3	29.5	.....	18.7	17.0	10.5	4.2	Immature.
43761	31900	Dept. Agric.	Council Bluffs, Iowa	♂	36.4	30.0	15.7	18.8	16.7	10.5	4.0	Adult.
54097	.....	.....do	Onaga, Kans	...	37.7	32.6	17.0	19.8	17.7	11.0	4.0	Do.
40407	.....	.....do	.....do	...	36.3	.....	15.8	19.5	17.0	11.2	4.5	Do.
64225	.....	.....do	Bismarck, Mo.....	♀	36.4	30.3	15.5	19.8	16.5	10.5	4.0	Do.
1638	503	Nat. Mus ...	St. Louis, Mo	...	38.5	32.0	17.5	20.8	18.2	.....	4.1	Old.
1639	504	.....do	.....do	...	37.5	31.5	17.0	19.8	17.2	.....	4.5	Adult.
1641	506	.....do	.....do	...	.....	.....	15.6	18.7	16.8	9.8	4.0	Do.
1642	507	.....do	.....do	...	38.6	.....	15.5	18.6	16.5	10.0	4.4	Do.
36936	7246	.....do	Grand Coteau, La..	...	34.0	28.5	14.5	18.0	16.0	9.7	4.0	Do.
2955	.....	Bangs	Mer Rouge, La.....	♂	34.4	28.2	14.3	17.2	15.5	9.4	4.2	Do.
2956	.....	.....do	.....do	♂	35.0	29.0	15.0	18.0	16.0	9.5	4.0	Youngish.
2957	.....	.....do	.....do	♂	34.0	28.0	15.0	17.0	.....	9.2	4.0	Adult, or less.
2958	.....	.....do	.....do	♂	33.0	27.0	14.0	17.5	15.5	9.1	4.2	Adult.
46384	34293	Dept. Agric.	.....do	♀	32.0	26.6	13.7	17.0	15.4	9.4	3.0	Do.
57030	.....	.....do	Greensboro, Ala...	♂	33.0	27.4	14.2	17.6	15.0	9.2	3.3	Youngish.
57031	.....	.....do	.....do	♀	32.4	27.2	14.0	.....	15.0	9.4	3.9	Do.
57029	.....	.....do	.....do	...	31.9	26.8	13.4	17.0	.....	9.0	3.9	Do.

Dimensions of skulls of Scalops aquaticus texanus.

Catalogue number. Skull.	Skin.	Collection.	Locality.	Sex.	Total length.	Basilar length (Hensel).	Length of palate from inside first incisor.	Mastoid breadth.	Greatest zygomatic breadth.	Breadth between postero-external angles of first molars.	Height of coronoid process.	Age.
					mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
43268	31403	Dept. Agric.	Padre Island, Tex.	♂	32.0	26.8	14.0	17.4	15.1	9.7	3.7	Adult.
43269	31404	....do	....do	♂	31.4	26.4	13.7	17.6	15.3	10.0	4.0	Adult, or less.
42883	31008	....do	Near Santa Rosa, Cameron County, Tex.	♂	30.3	25.3	.....	16.6	.....	.....	.....	Adult.
43267	31402	....do	Corpus Christi, Tex.	♂	32.5	26.5	14.1	17.5	15.3	10.0	4.3	Do.
43534	31664	....do	....do	♂	33.1	27.0	.....	17.5	.....	.....	.....	Do.
4485	5766	Amer. Mus.	Rockport, Tex.	♂	32.4	27.1	14.4	17.5	15.3	9.4	4.0	Do.
4487	5768	....do	....do	♂	32.0	26.6	13.9	17.4	15.2	9.2	4.3	Do.
51498	.....	Dept. Agric.	....do	♂	31.6	26.0	14.3	16.8	.....	8.7	4.0	Do.
51386	.....	....do	....do	♂	31.3	25.6	13.6	16.7	15.0	9.3	4.0	Do.
51385	.....	....do	....do	♂	31.2	25.4	13.8	17.6	15.5	9.7	4.3	Do.
51387	.....	....do	....do	♀	30.7	24.9	13.6	16.2	14.7	8.7	.....	Do.
4489	5770	Amer. Mus.	....do	♀	30.6	25.0	13.7	16.6	14.9	8.5	3.9	Do.
4486	5767	....do	....do	♂	30.2	.....	.....	16.4	14.1	8.4	3.7	Do.
4490	5771	....do	....do	♀	30.0	24.7	13.0	16.4	15.0	9.0	4.2	Do.
4488	5769	....do	....do	♀	29.5	24.2	12.8	16.0	.....	8.7	3.7	Do.
51388	.....	Dept. Agric.	San Antonio, Tex.	...	30.5	.....	.....	.....	.....	.....	3.8	Do.
5043	4323	Merriam	Mason, Tex.	...	31.1	25.6	13.2	16.5	.....	9.2	3.4	Adult, or less.
5044	4324	....do	....do	...	33.3	27.6	14.4	17.8	15.4	9.8	3.4	
5042	4322	....do	....do	...	.....	27.0	14.1	17.5	15.9	9.8	3.3	"Immature."
30913	23494	Dept. Agric.	Fort Reno, Okla	♂	33.3	27.4	14.2	17.2	15.5	9.3	3.8	Young.
2740	3488	Amer. Mus.	Aransas County, Tex. (1)	...	.....	.....	*14.8	.....	.....	10.0	.....	Type, old.

*Tooth row.

Genus SCAPANUS, Pomel.

Scapanus, POMEL, Archiv. Sci. Phys. and Nat., IX, 1848, p. 247. (Based on *Scalops townsendi* and *S. breweri*, Bachman.)

Body fusiform, depressed. Feet fossorial. Manus very broad, with large *os falciforme;* palms turned outward; toes not webbed. Muzzle produced; nostrils superior. Tail short, thick, terete, scaly, sparsely clothed with long hair. Auricular orifice and eyes minute.

Skull depressed; tympanic bullæ complete; anterior nares somewhat inclined upward. Palate only slightly prolonged behind the last molar. First upper incisors large. Internal basal cusp of molars narrow and simple.

Pelvis with two osseous bridges connecting the sacral vertebræ with the ischium.

Dental formula: i, $\frac{3}{3}$; c, $\frac{1}{1}$; pm, $\frac{4}{4}$; m, $\frac{3}{3}$; total, 44.

This genus is very closely allied to *Scalops*, from which it differs chiefly in the number and relative size of the teeth. In *Scalops* the third lower incisor and the lower canine are wanting in the functional dentition and the premolars are but three above and below, while in *Scapanus* the incisor and canine are present and also four premolars.

The second and third upper incisors in *Scapanus*, though small, are not minute as in *Scalops*.

The nostrils are commonly stated to be "supero-lateral" in *Scapanus* and superior in *Scalops*, but I am unable to discern any difference in their position in the two genera; they are superior in both.

Since establishing the genus *Scapanus*, by Pomel, in 1848, both Townsend's mole and Brewer's mole have been constantly included in it. The latter species presents very distinct osteological characters, however, and I have separated it under the name of *Parascalops*.

Pomel introduces the genus *Scapanus* in the following manner:[1]

"2e type [des Talpiens], LEPTORHINIENS, trompe grêle aiguë; narines ouvertes près de l'extrémité."

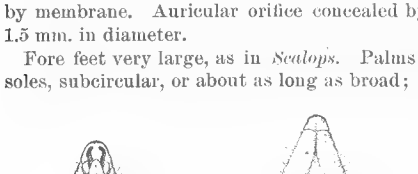
Genres *Hyporyssus*?,[2] *Scalops*, *Scapanus*.

NOTA.—Ce troisième genre diffère des scalops par la position latérale et non supérieure de l'ouverture des narines, et par la formule dentaire comprenant une intermédiaire supérieure et trois inférieures de plus. Les espèces sont: *Scapanus Townsendii* [sic] et *Breweri* (*Scal. Townsendii* [sic] et *Breweri* Bachm.).

EXTERNAL CHARACTERS OF THE GENUS.

Body fusiform, depressed. Head conical. Snout, nostrils, and lips as in *Scalops aquaticus*. Eye minute, concealed in the fur but not covered by membrane. Auricular orifice concealed by the fur, circular, about 1.5 mm. in diameter.

Fore feet very large, as in *Scalops*. Palms (with toes) shorter than soles, subcircular, or about as long as broad; naked and pseudo-tubercular below; sparsely hairy above, with a conspicuous fringe. Toes scarcely webbed. Claws very large and broad, as in *Scalops aquaticus*.



12. 13.

SNOUT OF SCAPANUS TOWNSENDI.

Fig. 12, Upper surface. Fig. 13, Lower surface.

($1\frac{1}{2}$ times natural size.)

Hind feet long and narrow. Upper surface covered with rather sparse long hairs, the outer of which form a fringe around the sides of the soles, which fringe is especially long on the outer side of the heel. Under surface naked, with one prominent tubercle near the middle. Toes scarcely webbed. Claws very long, compressed, curved, acute.

Tail thick, terete, tapering toward the extremity, and usually con-

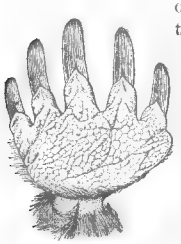
[1] Archiv. Sci. Phys. & Nat., IX, 1848, p. 247.

[2] The mark of interrogation is Pomel's. *Hyporyssus* is a fossil genus from the Tertiary of Auvergne, France.

stricted at the base; skin scaly, clothed with long, coarse hairs, which are not sufficiently numerous to conceal the skin itself.

Fur as in *Scalops aquaticus*.

Color blackish, varying to rich, dark metallic brown and to silvery gray. Under surfaces usually considerably lighter than the back. Hairs plumbeous, with a subterminal whitish, grayish, or rusty ill-defined ring and shining brown, gray or blackish tips. Hairs of the snout white; those of the feet and tail similar, varying to brownish (especially in immature individuals).



14. 15.

FORE FOOT OF SCAPANUS TOWNSENDI.
Fig. 14, Lower surface. Fig. 15, Upper surface.
(Slightly above natural size.)

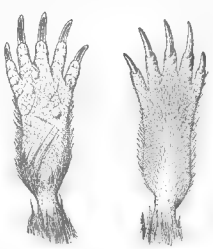
SKULL.

The skull of *Scapanus townsendi* resembles that of *Scalops aquaticus* so closely in most of its features that I do not think it necessary to describe it in detail, but will point out the characters in which the two skulls differ most conspicuously.

In *Scapanus townsendi* the interparietal[1] is large, broad, and strap-shaped, cutting off the parietals transversely behind, and causing their postero-lateral border to be much shorter than their posterior border. The supero anterior extremity of the premaxillæ is little produced, and hence the anterior nares have the appearance of being directed somewhat upward.

18.

TAIL OF SCAPANUS TOWNSENDI.
(Slightly above natural size.)



16. 17.

HIND FOOT OF SCAPANUS TOWNSENDI.
Fig. 16, Lower surface. Fig. 17, Upper surface.
(Slightly above natural size.)

The palate is short, its prolongation posteriorly beyond the last molar being much less than the diameter of that tooth. It is emarginate behind and notched. The zygomatic arches are short and nearly parallel. They spring anteriorly from a point about opposite the middle of the last molar, and are inserted behind considerably within the margin of the postero-external wing of the squamosal, which latter is

[1] Following De Blainville and Wagner, I regard the portion of the occipital bone anterior to the rudimentary lambdoidal ridge as representing an interparietal. In none of the skulls of American moles which I have examined, however, even the youngest ones, have I found more than an indication of a separation of the interparietal from the occipital. (See De Blainville, Osteographie, 1, Insectivores, p. 4; Wagner, Schreber's Säugethiere, II, p. 106.)

bent backward rather than outward. The termination of the triangular coronoid process of the mandible is broadly truncated. The angular process is large and strongly uncinate.

TEETH.

Dental formula: i, $\frac{2}{3}$; c, $\frac{1}{1}$; pm, $\frac{4}{4}$; m, $\frac{3}{3}$; total, 44.

The first upper incisor is large and elongate, with a convex anterior and flat posterior face and broad cutting edges. The second and third incisors and the canine are subequal, terete, unicuspidate teeth. The first premolar is similar, but decidedly smaller. The second and third premolars are similar; both teeth (especially the third) show a tendency to develop a posterior cusp.

The fourth premolar is larger than any tooth that precedes it. The crown is compressed and recurved and has a large lamellar posterior cusp, and a minute internal basal cusp and also usually a rudimentary anterior basal cusp. The molars are similar to those of *Scalops aquaticus*, the internal basal cusp being compressed and simple and not extending across the posterior external cusp.

The first lower incisor is shorter than the second (and in *Scapanus californicus* much smaller). The third incisor is smaller than the second (in *Scapanus californicus* much smaller). The canine and first, second, and third premolars are subequal and larger. All these teeth are single-rooted and unicuspidate, except the premolars, which tend to form a posterior basal cusp of considerable size. The fourth premolar is larger than the others, with a pronounced posterior basal cusp and a rudimentary anterior one. The molars resemble those of *Scalops aquaticus*.

SKELETON.

The vertebral formula in this genus is as follows: c, 7; d, 14; l, 5; s, 6; ca, 13 (or 14). Total, 45 (or 46). There are seven intervertebral ossicles, of which the anterior one (which is smaller than the rest) is between the penultimate and last dorsal vertebræ, and the last between the posterior lumbar and first sacral.

The sternum consists of 5 segments and a very large manubrium, which is as long as the combined segments. The first pair of ribs joins the sternum a little behind the junction of its intermediate and posterior third. The manubrium is dilated above and moderately grooved, with raised, but only slightly incurved, borders; the keel is not as deep as in *Scalops*, its greatest depth being less than one-third its length.

The clavicles are about two-thirds as long as broad, deeply notched on the inferior border, and not pierced by a foramen.

The scapula is as in *Scalops*, but has a prominent tubercle at the distal extremity of the inferior spine. The humerus is a fourth longer than broad.

The pelvis is extremely narrow, but the bones of the two sides do

not meet below the acetabula. The space between the sacral vertebræ and pelvis is closed in above by osseous bridges leaving only two pairs of foramina of moderate size.

The femur is a fifth shorter than the tibia. The fibula joins the latter a little above the middle.

The *os falciforme* is large and strap-shaped, only slightly curved and with an oblique proximal articulate surface. Terminal phalanges bifid.

KEY TO SPECIES OF SCAPANUS.

A. Premolars $\frac{4}{4}$.
  a. Color blackish. Face long; suborbital bridge broad—
    aa. Size very large (total length, 184 mm. alc.).....*townsendi* (p. 51.)
    bb. Size very small (total length, 158 mm.).....*orarius* (p. 52.)
  b. Color brown or brownish silvery. Face short; unicuspidate teeth crowded. Suborbital bridge slender. Size moderate.....*californicus* (p. 52.)
B. Premolars $\frac{3}{4}$. Color dusky brown. Size very small (total length, 135 mm.). *anthonyi* (p. 53.)

SCAPANUS TOWNSENDI (Bachman).

TOWNSEND'S MOLE; OR OREGON MOLE.

Scalops canadensis, RICHARDSON, Fauna Bor. Amer., pt. 1, 1829, p. 9. [Not of Desmarest or Harlan.]

Scalops Townsendii, BACHMAN, Journ. Acad. Nat. Sci. Phila., VIII, pt. 1, 1839, p. 58; Proc. Boston Soc. Nat. Hist., I, 1841, p. 41; Boston Journ. Nat. Hist., IV, No. 1, 1842, p. 31; Journ. Acad. Nat. Sci. Phila., VIII, pt. 2, 1842, p. 294.

Scalops latimanus, BACHMAN, Boston Journ. Nat. Hist., IV, No. 1, 1842, p. 34.

Scapanus Tow[n]sendii, POMEL, Archiv Sci. Phys. & Nat., IX, 1848, p. 247.

Scalops metallescens, CASSIN, Proc. Acad. Nat. Sci. Phila., VI, 1853, p. 242. (*Nomen nudum.*)

Scalops æneus, CASSIN, Proc. Acad. Nat. Sci. Phila., VI, 1853, p. 299.

Talpa tæniata, LECONTE, Proc. Acad. Nat. Sci. Phila., VI, 1853, p. 327.

Size very large. Color blackish. Tail twice as long as the fore foot (without the claws); the latter shorter than the hind foot. Face long (interval between first upper incisor and last premolar equal to length of the three upper molars).

Upper unicuspid teeth separated by equal intervals. First lower incisor approaching the second in height.

Suborbital bridge broad and pressed close to the side of the skull. Coronoid process of mandible broadly truncated.

Dimensions (No. 2212, Fort Steilacoom, Washington. Female. Alc.)—Total length, 184 mm.; head and body, 141 mm.; head, 52.5 mm.; tail vertebræ, 39.5 mm.; length of hind foot (without claw), 20.5 mm.; length of fore foot (without claw), 19 mm.

Average dimensions of skulls.—Total length, 41.4 mm.; mastoid breadth, 19.9 mm.; length of palate from outside of incisor, 18.6 mm.

Distribution.—Washington and Oregon, between the Cascade Mountains and coast range, extending in the extreme northwestern portion of California to Crescent City.

SCAPANUS ORARIUS, new species.

COAST MOLE.

Similar to *S. townsendi*, but representing nearly the opposite extreme as regards size. Head and body not exceeding 128 mm.; color, dark.

Skull and teeth as in *S. townsendi*, and the face long.

Dimensions (No. 3480, G. S. Miller. Sumas, British Columbia).—Total length, 158 mm.; tail, 30 mm.; hind foot, 20 mm.

Dimensions of skull.—Total length, 32.8 mm.; mastoid breadth, 16 mm.; length of palate from outside of incisor, 14.3 mm.

Geographical distribution.—Seacoast of Washington and Oregon, from the Coquille River northward, and along the shores of Puget Sound to Similahmoo and to Chiloweyuck Depot and Sumas, British Columbia. Fort Walla Walla, Washington.

Type.—No. 381, U.S.N.M. Female. Shoalwater Bay, Washington. August 30, 1855. Dr. J. G. Cooper.

SCAPANUS CALIFORNICUS (Ayres).

CALIFORNIA MOLE.

Scalops californicus, AYRES, Proc. Calif. Acad. Nat. Sci., I, 1855, p. 54.
Scapanus dilatus, TRUE, Proc. U. S. Nat. Mus., XVII, 1894, No. 999, p. 242.

Size moderate (with a considerable geographical variation), not reaching that of *S. townsendi*. Color gray-brown, often pale or more or less suffused with rust color. Face short (the interval between the first upper incisor and last premolar equal only to the first and second upper molars).

Unicuspidate teeth crowded and more unequal in size than in *S. townsendi*. First lower incisor very short; second, long and canine-like.

Skull delicate; suborbital bridge slender, not pressed in toward the sides of the skull.

Average dimensions (4 fresh specimens from Nicasio, Marin County, California).—Total length, 179 mm.; tail vertebræ, 35 mm.

(No. 12624, U.S.N.M., alc.; Santa Barbara, California, male, adult: Total length, 154 mm.; head and body, 121 mm.; head, 45.5 mm.; tail vertebræ, 33.5 mm.; hind foot (without claw), 17 mm.)

Average dimensions of skulls (7 adults from Nicasio, California).—Total length, 36.3 mm.; length of interval between first upper incisor and last premolar, 5.5 mm.; greatest mastoid breadth, 17.4 mm.; greatest zygomatic breadth, 14.4 mm.

(Average dimensions of skulls from Alhambra, San Bernardino, and San Gabriel, southern California: Total length, 32.3 mm.; greatest mastoid breadth, 15.9 mm.)

Geographical distribution.—All California west of the coast range (except the extreme northwestern portion), and the Sierra Nevadas at varying altitudes, and east thereof at Owens Lake, Lake City (Modoc County), and Lake Tahoe, California, and Fort Klamath, Oregon.

Type locality.—San Francisco, California.

SCAPANUS ANTHONYI, J. A. Allen.

ANTHONY'S MOLE.

Scapanus anthonyi J. A ALLEN, Bull. Amer. Mus. Nat. Hist., V, 1893, p. 200.

Smaller than the average of specimens of *S. californicus* from southern California, and the color considerably darker. Length, 135 mm.; tail, 26 mm.

"*Cranial characters.*—Similar in general to those of *S. townsendii*, except that the interorbital and rostral portions of the skull are relatively broader. The fourth premolar on one side, however, is wanting, and on the other is rudimentary; but this may be abnormal.[1] Extreme length, 30 mm.; basilar length, 28.5 mm.; least interorbital breadth, 7.6 mm.; greatest mastoid breadth, 15.3 mm.; lower jaw, incisive border to condyle, 22.4 mm.

"*Type.*—No. $\frac{8}{4}\frac{3}{9}\frac{1}{4}\frac{3}{7}$, ♂ ad., San Pedro Martir Mountains (alt. 7,000 feet), May 8, 1893. Coll. A. W. Anthony.

"This species is based on a single male specimen, and, although so small, the worn condition of the teeth show it to be an old individual.

"In general bulk *S. anthonyi* is less than half the size of *S. townsendii* [read *S. californicus*] from Nicasio, California." (Allen.)

GEOGRAPHICAL DISTRIBUTION.

The distribution of the moles of the genus *Scapanus* on the Pacific Coast, so far as it may now be known, presents many interesting peculiarities. The range of the genus extends from Chiloweyuck Depot in British Columbia just north of the United States boundary to the San Pedro Martir Mountains, Lower California. In four instances specimens have been taken from east of the Cascades and Sierra Nevada Mountains, namely, at Fort Walla Walla, Washington; Fort Klamath, Oregon; Bijou, on Lake Tahoe, California, and Olancha, on Owens Lake, California.[2] Otherwise, all the specimens examined as well as those mentioned in the literature are from localities west of the summits of the Cascades and Sierra Nevadas, and south of the latter mountains. The moles are abundant about Puget Sound and in the western valleys of Washington and Oregon, as shown by both specimens and records.[3]

They have also established themselves east of the mountains at Fort Walla Walla, where three were obtained by Major C. E. Bendire. Farther south they have passed through the mountains to the region of

[1] I find only three premolars on either side.

[2] I have recently noticed a specimen in the collection of the Department of Agriculture from Lake City, Modoc County, California, June 15, 1895. It is of a silvery color and resembles the Shasta County specimens. The fur is long and silky, but dull. The skull, which is not adult, is of the following dimensions: Total length, 35 mm.; interval between first incisor and last premolar, 5.8 mm.; mastoid breadth, 15.6 mm.

[3] "Well known to the farmers and settlers in the valleys of Oregon." (Aud. & Bach., Quadrupeds, III, p. 219.)

the Klamath Lakes. Major Bendire obtained three specimens at Fort Klamath. Feilner found moles in this region in 1864. He writes:

> I have two kinds, one caught on Bogus Creek, with glistening silver-gray fur, and the other on Klamath River, with black fur and velvet-like appearance.[1]

At the junction of the Sierra Nevadas with the coast range at the northern boundary of California the area of distribution appears to divide, one arm following the coast range and covering the country toward the ocean, and the other extending southward in the Sierra Nevadas. I have examined one specimen from Baird, in Shasta County, one from Fort Crook, and one from Berkeley, on the east side of San Francisco Bay, but from the whole great Sacramento Valley specimens are entirely lacking.

Regarding the Sierra Nevadas we have only the testimony of Mr. W. W. Price.[2] This observer obtained a specimen at Red Point, in Placer County (altitude, 4,500 feet), in the tongue of land between the north and middle forks of the American River; but he remarks also:

> The marks of moles were seen all over the high sierras [of Placer and Eldorado counties], especially about the snow fields on Mount Tallac, but no specimens were taken.

South of the Sierra Nevadas there are specimens from Los Angeles, Alhambra, San Gabriel, and the town and peak of San Bernardino, but none from east of the mountains of this region. There are none from San Diego County, but Mr. Stephens notes that the mole is common in damp lands in the county, especially in the mountains.[3]

Thus the range of the genus is carried to the southern boundary of the United States. Beyond we have only one specimen, the type of *S. anthonyi* from the San Pedro Martir Mountains, 150 miles south of the boundary, in Lower California. The collector, Mr. Thurber, reported that moles were rare.[4]

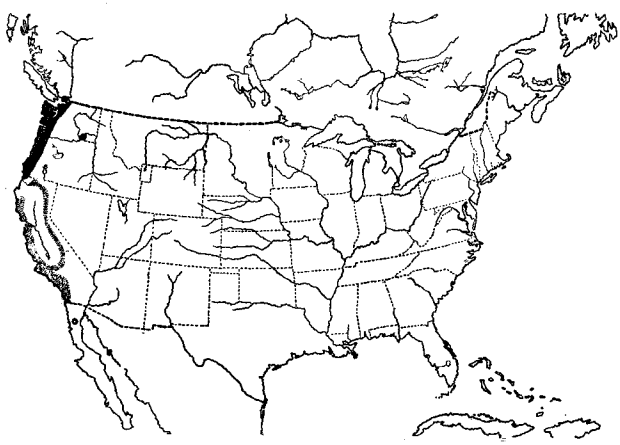
East of the Sierras in California, as already stated, specimens have been obtained in only two localities—Bijou, at the south end of Lake Tahoe, and Olancha, on Owens Lake (elevation 3,700 feet).[5] I think it probable that the mole follows the mountains westward from the latter locality along the north side of the Mohave Desert to the coast range, and also, perhaps, northward to Lake Tahoe. A specimen recently received from Tehachapi, Kern County, tends to confirm this view, so far as the western extension is concerned, while Mr. Price's observation (already quoted) is of interest in connection with the northern extension.

Of the species recognized in this work, the typical one, *S. townsendi*, ranges from the northern boundary of the United States over that

[1] Smithsonian Report, 1864, p. 424.
[2] Zoë, 4, 1893, p. 326.
[3] Stephens, West Amer. Scientist, VII, 1890, p. 39.
[4] Bull. Amer. Mus. Nat. Hist., V, 1893, p. 200.
[5] See footnote, p. 53.

portion of Washington and Oregon lying between the Cascade Mountains and coast range, and a short distance into California along the coast. The most southerly specimen examined was from Crescent City, Cal. Here the species appears to end, though it may go a little farther south. It shows no disposition to grade into *S. californicus*, which reaches up toward it. The character of the moles inhabiting the area between Crescent City and Cahto remains to be determined, but they will probably prove to be *S. californicus*.

On the seacoast of Oregon, from the Coquille River northward, on the coast of Washington, the south shore of the Straits of Fuca, and both sides of Puget Sound, we find another species, *S. orarius*, dark colored, like *S. townsendi*, but very small. This lives with *S. townsendi* at Steilacoom and probably at other points about Puget Sound. It occurs also at Chiloweyuck and Sumas, British Columbia.



GEOGRAPHICAL DISTRIBUTION OF THE SPECIES OF SCAPANUS.[1]

There is a species, as we have said, living at Fort Walla Walla, as evidenced by specimens in the National Museum collection obtained by Major Bendire. But whether it is to be associated with *townsendi* or *orarius* is uncertain. The material at command consists only of three youngish individuals in alcohol. The skull of one of these, which exhibits characters of immaturity, is larger than adult *orarius* from Sumas, but smaller than youngish *townsendi*. I am inclined to regard it as an offshoot of *orarius*, but when more specimens have been collected along the Columbia River eastward of the Sierra

[1] Cross hatching indicates *Scapanus orarius;* heavy stippling, *S. townsendi;* light stippling, *S. californicus;* and small circle in Lower California, *S. anthonyi.*

Nevadas, it may be shown that the mole of this region unites with *townsendi*, or even that *orarius* and *townsendi* merge into each other in this roundabout way.

In California, if my views are correct, there is only a single varying species, *S. californicus*. This occupies the coast country along its entire length, except perhaps, the most northerly part near the boundary. At the south it extends no farther east than the San Bernardino Mountains, and follows the higher land up to the southern rampart of the Sacramento Valley. It does not enter the valley, so far as known, but is diverted east and west: one portion of the range, as already stated, covering the coast country east of the coast range, and the other extending along the Sierras, probably throughout the whole range in suitable localities, up to Shasta County (Fort Crook, Baird, etc.), and beyond in Oregon to the Klamath Lake region. The species occurs at Owens Lake and Tahoe Lake, as already stated, both of which are on the eastern slope of the Sierras, but at considerable elevations.

South of the Mexican border we have only one species, *S. anthonyi*, and this is known only from one specimen obtained in the San Pedro Martir Mountains, at an elevation of 7,000 feet.

THE SPECIES OF SCAPANUS.

On the basis of the specimens examined, I am disposed to recognize four species of *Scapanus*. The typical species, *S. townsendi*, is a large dusky mole, with a long face. The color is much darker than is ever attained by *Scalops aquaticus* and is almost precisely that of *Parascalops*. The skull is noticeably large and massive, and the bridge of bone limiting the suborbital foramen behind is broad and depressed. The lateral unicuspid teeth are large and terete, and form a regular row. They are noticeably more widely separated from one another than in the more southern species. The interval between the first upper incisor and the last premolar exceeds 17 per cent of the total length of the skull, while in the Californian species this interval rarely reaches 16 per cent and is generally about 15 per cent. This character, together with the large size, is sufficient to separate *S. townsendi* from the Californian species. In the vicinity of Puget Sound and along the coast of Washington and northern Oregon is a second species, *S. orarius*, which is also dark colored and long-faced, and presents the cranial characters of *S. townsendi*, but is at once distinguishable by its very small size. In California we find a third species, which is distinguishable from the other two externally by its lighter color. It has a short face. It is a variable species as regards size, reaching almost the proportions of *S. townsendi* in the northern part of its range and becoming smaller than *S. orarius* at the South. It is also somewhat variable in color, as will be shown more in detail presently.

Townsend's mole, *S. townsendi*, presents very little variation either in size or color. It is as dark, or nearly as dark, at Crescent City, California, the southern limit of its range, as about Puget Sound, and it

shows no tendency toward a diminution in size at that point. The same is the case with *S. orarius*, if we except the evidence supplied by the Fort Walla Walla specimens. If these specimens represent an offshoot of *S. orarius*, as I have supposed, it may be shown hereafter that a large form of *orarius* occupies the western border of the Columbia plains.

The California mole, like the Eastern *Scalops aquaticus*, presents a wide range of variation in size. Along the northern coast we find the maximum. Toward the south there is a gradual falling off, until in the southern counties a minimum is reached. The conditions in the Sierra Nevadas, as far as can be determined from the very few specimens available, are somewhat different. In the Sierras themselves the species appears to maintain a comparatively large size throughout. Specimens from Baird, Fort Crook, and Bijou (Lake Tahoe) are about the same size as the single one from Tehachapi, at the extreme south of the Sierras, while on the other hand they are smaller than specimens from northern localities on the coast.

The specimens from Olancha, Owens Lake, elevation 3,700 feet, on the east slope of the Sierras, and considerably north of the latitude of Tehachapi, are very small, almost at the minimum, although the real minimum on the coast is found much farther south.

The variation in color in *S. californicus*, making due allowance for seasonal changes, can not be considered very great. Specimens from Los Angeles County are a little browner than those from the vicinity of San Francisco Bay, and the Owens Lake specimens, are, perhaps, paler. The only very pale specimen, however, is one from the peak of St. Bernardino, which has the fresh winter pelage. This is very silvery, and is comparable to specimens of *Scalops aquaticus* from Wisconsin.

S. anthonyi is the smallest form of *Scapanus* on the Pacific Coast and is at the point farthest south in the range. The type is an old individual, as stated by Dr. Allen, having the depressed cranium, short interparietal, and worn teeth, indicative of age. It is darker than specimens from various parts of southern California, but is about equaled by one from Pacific Grove, Mendocino County. In other respects there does not seem to be any distinction between *S. anthonyi* and ordinary California moles. Dr. Allen does not give any other characters except one relating to the dentition. The premolars are only three in each side of the upper and lower jaws. If this is constant, it forms a marked characteristic of the species. With only one specimen at hand, however, nothing can be certainly determined.

I am strongly inclined to regard this species as merely an outlying geographical race of *S. californicus*, but as material from southern California is not so abundant as could be desired, and the species itself is represented only by the type specimen, I have thought best to preserve its status as established by the describer. Those naturalists who regard isolation as a guarantee of specific distinctness will probably

continue to call it a species, as the mountain which it inhabits is cut off from more northerly ones by a considerable extent of arid territory. It is a nice question to decide how great a degree of isolation is sufficient to warrant the recognition of a species. No one will doubt, I presume, that the characters which this form presents (with the exception of that relative to the dentition) are a function of humidity and food supply.

In 1842 Bachman described a species which he called *Scalops latimanus*,[1] basing it in part on a specimen in the Berlin Museum, supposed to be from Mexico, and in part on a second specimen which he received from Texas. What the Texas specimen really was is not discoverable, but in 1864 Peters pointed out that the specimen which Bachman supposed to be from Mexico was sent to the museum from Monterey, California, by Deppe, and was collected in October, 1834, in Santa Clara. Peters seems to have been in doubt as to whether this latter locality was not in Sonora, Mexico, but probably Santa Clara, California, is the place intended. However this may be, the description of the specimen seems to indicate that it must have come from the extreme northern portion of California, or from Oregon. The color and size are not those of the mole of southern California. This being the case, it seems reasonable to regard the species as synonymous with *Scapanus townsendi*.[2]

Another nominal species is Cassin's *Scalops æneus*, based on a specimen obtained by the United States Exploring Expedition in Oregon. The type skin, No. 3725, is still in the National Museum, but the skull has disappeared. All the remarkable characters of this species, such as black claws, bronze coloration, etc., are unnatural, and suggest the conclusion (of which I think there can be no question) that the specimen was kept in a copper tank in alcohol which had attacked the walls of the tank, and held copper salts in solution. I have seen other specimens which presented the same appearance, and were known to have suffered from the same cause. Allowance being made for the discoloration, the specimen appears to be a youngish individual of typical *S. townsendi*. (I have given the measurements of the type on p. 64.)

Another nominal species is the *Talpa tæniata* of LeConte,[3] described in 1853 and based on one of the two typical specimens of *S. townsendi*, which had an irregular white mark on the belly. This specimen was collected by Townsend on the banks of the Columbia River, May 9, 1835, probably at or near Fort Vancouver, Oregon, which is also the locality from which the real type of *S. townsendi* was obtained.

The characters employed by LeConte are as follows:

Nares superni, cauda brevi parce pilosa. Cinero-nigra, pedibus pallidus, fronte vittaque inferna albis.

[1] Boston Journ. Nat. Hist., IV, 1842, p. 34.

[2] Monatsberichte der k. Preuss. Akad. Wissensch. Berlin, 1863, (1864), p. 656.

[3] Proc. Acad. Nat. Sci. Phila., VI, 1853, p. 327.

The third tooth of the upper jaw following the large incisor is more elongated than in the true Talpa Townsendii; the posterior cusps of the 7th and 8th lower teeth, although distinct, are smaller than in T. townsendii and there is no distinct internal basal margin connected with the cusp.

My study of the group leads me to believe that the peculiar coloration is merely an individual variation. The characters ascribed to the teeth could only be considered important if the teeth were unworn. The changes due to use are greater than those here employed for specific differentiation.

CHANGE OF PELAGE IN SCAPANUS.

The change of pelage in this genus appears to begin on the breast and to extend thence to the head and back and finally to the belly, on which the new hair intrudes both from the breast and the sides.

The specimens at command are not sufficient to make entirely plain the dates at which the changes begin and are completed in the several species. In southern Washington and northern Oregon the fall change of *S. townsendi*, probably begins about the first of October. One specimen from Tenino, Washington, has the entire new pelage October 19, and I may conclude that, in males at least, the molt ends about this time. In northern Oregon the change has not affected the belly at this date, so that the molt is probably not completed here before the first of November.

The dates for *S. californicus* are probably somewhat later, and in southern California the fall molt probably begins as late as November 1. In a male obtained in Marin County November 23 and a female obtained November 27, the belly still retains the old fur, so that in this part of northern California the fall molt can scarcely be completed until after the 1st of December.

In relation to the spring molt, we find the following: A specimen of *S. townsendi* from Tacoma, Washington, taken in May, has the new fur on the breast and head and along the middle of the back; there are also a number of small irregular patches of new hair on the belly.

Of *S. californicus*, a female from Nicasio, California, captured May 10, a male May 15, another male May 22, and a second female June 26, all have the appearance of having completed the molt. It is quite probable, however, that they have not yet commenced, as appears from the fact that a female from the same locality, taken May 29, has the new fur developed only on the breast, and is just starting on the head and hinder part of the back. A female from Cazadero, Sonoma County, taken July 5, has shed on the neck, head, and most of the back, but not on the rump, sides, or belly.

In this specimen the old and new fur are so closely alike in color except on the breast that the line of demarkation can only be detected by very close scrutiny. Another specimen (a female?), taken at Nicasio July 12, still has a small patch of old fur on the sides of the belly, and one from Gualala, taken July 14 (marked male, but probably female),

has shed only on the head and breast, but new fur is elsewhere concealed under the old. A female from Olancha, Owens Lake, California (altitude 3,700 feet), taken June 12, has new fur on the breast and head and along the middle of the back. In a male from San Bernardino, Cal., captured June 7, the change has gone a little further, involving nearly the entire upper surfaces and the under surfaces as far as the middle of the belly. It is rather surprising to find that a male from Alhambra, Los Angeles County, California, taken June 21, has not changed at all, the new hair reaching up only to the middle of the old, and this only on the back.

INDIVIDUAL VARIATION IN SCAPANUS.

There are two kinds of variation which may be termed "individual," one a congenital variation and the other acquired. Of congenital variation, there does not seem a great deal among the Pacific Coast moles. A specimen of *S. californicus* from Alhambra, California (a male), and one from Cazadero (a female) have a small line or tawny-white mark on the left side of the face. This probably represents incipient albinism, and is congenital.

Acquired variations in color arise from staining by secretions, fading, etc. Where these affect the whole body, it is not always easy to determine whether they are accidental or seasonal. When the lower part of the hairs, which are ordinarily pure plumbeous gray, is affected, it may, I think, be supposed that the alteration is accidental and due to external causes. Thus, three skins of *S. californicus* from Alhambra, California, exhibit large areas, on the back and elsewhere, of a bright bronzy color, which color affects, to a certain degree, the lower part of the hairs, which are far from being pure gray. A specimen of *S. townsendi* from Seaton, Oregon, taken October 5, shows a somewhat similar suffusion over nearly the whole body, though it is less conspicuous, as the Oregon moles are very dark-colored. In this instance the discolored fur is old fur, the new fur appearing at its roots.

Several specimens small show tufts here and there of fur which is whitish or tawny throughout, as is sometimes seen in *Scalops*. These spots do not seem to be due to age.

The most noticeable individual variations in the skulls are those which affect the teeth. These variations are few in number and consist in reductions of the normal number of teeth. Only four cases of this kind are to be found among the skulls which I have examined. A skull of *S. californicus* from San Gabriel, California, lacks the first upper premolar on the right side.[1] One from Nicasio lacks the third upper incisor on the left side, and another from the same locality lacks the second

[1] It is not always possible to determine the proper name of the missing tooth. When a premolar is lacking, for example, the remaining teeth frequently change their normal position, so that no large hiatus is left.

incisor on both sides. A skull from Fort Klamath, Oregon, has no first upper premolar on either side.[1]

I have not detected any reduction in the number of mandibular teeth.

AGE VARIATIONS IN SCAPANUS.

The variations depending on age which are of the most interest are those affecting the shape of the skull and teeth.

Youngish skulls, or those in which the teeth are unworn, have a high, rounded brain case and smooth surface. The sutures, from the frontals backward, are open, but these apparently are never obliterated, even in extreme old age. The facial sutures become closed at a comparatively early age, and are rarely to be distinguished in skulls with worn teeth. The sutures at the base of the cranium, on the contrary, close very early, even before the milk teeth are all shed.

As age progresses, while the inferior half of the brain case remains unchanged, the superior half becomes depressed, especially in front, where the parietals meet the frontals, so that the frontal sinuses have the appearance of being elevated.

The arcuate transverse occipital ridge, which appears to mark the union of the occipital with an interparietal, becomes more pronounced and moves forward, so that the "interparietal" is much narrower than young skulls. This change is very striking and might easily be mistaken for a specific character. The elliptical capsule which covers the superior vermis of the cerebellum becomes more prominent.

All the ridges of the skull are, of course, more strongly developed as age progresses. There is a distinct but low sagittal crest. The postero-external margin of the squamosal is thickened and the surface of the maxillæ immediately in front of the frontals is depressed.

The changes in the form of the teeth are very striking. The unicuspidate teeth are at first long, slender, and sharp, and (in northern specimens at least) separated by considerable intervals. As they become worn there is an apparent increase in size, so that the intervals between them are nearly or quite closed, and they are short and massive. The small internal and anterior basal cusps of the last upper premolar are usually obliterated, as well as the posterior cusp of the first and second premolars.

The changes in the molars are not less striking. Not only are the cusps entirely worn off in age so that the inferior or grinding surface of the teeth is nearly or quite flat, but the shape of the cusps themselves is altered. The small accessory cusps of the upper molars are obliterated, and the internal basal cusp is worn away not only at the extremity but at the sides, so that it takes a new form and is much narrower in proportion to the whole tooth than in unworn teeth.

The lower molars suffer similar changes. In the last molar the

[1] This is No. 1286, Merr. Coll., the type of my *Scapanus dilatus*. This species, based chiefly on the absence of the premolar, I now regard as invalid. (See p. 64.)

posterior lobe, which ordinarily approaches the anterior lobe in size, may be worn to a mere rounded tubercle, connected with anterior lobe by an extremely narrow bridge.

It is obvious from these facts that characters drawn from the shape of worn teeth can be of little value in distinguishing species.

As regards external characters, it may be said that those individuals in which the hairs of the tail and hind feet are brownish are young, while those which have this hair white are mature or old. Old individuals often have in addition small tufts of entirely white or whitish fur mingled with normal fur; but in some cases this appears to be merely an individual peculiarity, and is not due to age.

Very young moles appear to be much lighter and more silvery than the adults. This appearance is heightened by the circumstance that the fur (at least in dry skins) is closely appressed and the surface color is not clouded by intermixture with the dark color of the basal portion of the hairs.

SEASONAL DIFFERENCES IN COLOR IN SCAPANUS.

Between the fresh winter and summer pelages there is not so much difference in color as might be expected. The winter fur is usually darker and grayer, while the summer fur is paler and has more of a reddish tinge. Worn pelage is pale and faded and often suffused with dull yellowish. There is not that sharpness of boundary between the brown tips of the hairs and the plumbeous lower portion which exists in new fur. In some instances, however, the old and new fur are so closely alike in color that the boundary between them can only be detected by the closest scrutiny.

HISTORY OF THE SPECIES OF SCAPANUS.

The occurrence of moles on the Pacific Coast was known to Lewis and Clarke,[1] whose expedition was undertaken at the beginning of the present century, and perhaps to earlier explorers, but they were first given a place in scientific nomenclature by Richardson, in 1829,[2] who called the species "*Scalops canadensis* (Cuvier)." Cuvier did not really use this Latin name for any species, but did apply its French equivalent, "Scalope du Canada,"[3] to the Eastern mole, *S. aquaticus*. Richardson supposed that the two moles were specifically the same, and remarks:

> The Columbia animal [*Scapanus townsendi*] seems to be of larger dimensions, and has a longer tail than the Shrew moles of the United States [*Scalops aquaticus*]; but I have not detected any other peculiarities by which it might be characterized as a distinct species.[4]

[1] See the History of the Expedition of Lewis and Clarke, Paul Allen, editor, II, 1814, p. 178.

[2] Richardson, Fauna Boreali Americana, Mammalia, 1829, p. 9.

[3] Règne Animal, 1st ed., I, 1817, p. 135.

[4] Richardson, loc. cit., p. 11.

His description, however, is strictly applicable to *Scapanus townsendi*. It would be necessary to use the name *canadensis* for the northern Pacific Coast mole were it not that other writers applied this latinized form of Cuvier's appellation at an earlier date to *Scalops aquaticus*—namely, Desmarest in 1820, and Harlan in 1825.

We must, therefore, seek out the next name used for our northern Pacific Coast species, which is Bachman's *Scalops townsendii*, established in 1839.[1] Bachman had two specimens, one of which was given him by Nuttall and the other he subsequently received from Townsend. The former is the type. Exactly where it was captured is not stated in connection with the original description, but later Bachman[2] remarked that he believed that it was from the same locality as Townsend's specimen. The latter was from the "banks of the Columbia River, May 9, 1835." At this date Nuttall and Townsend were together on the Columbia, at Fort Vancouver, or at Warrior's Point, about 20 miles down the river, having recently returned from a voyage to the Sandwich Islands. It may be assumed, therefore, that the locality of the type was Fort Vancouver, or the immediate neighborhood.

In 1842, when reviewing the genus *Scalops*, Bachman described another western species,[3] *S. latimanus*, basing it on a specimen in the Berlin Museum, which he supposed to have been obtained in Mexico, and one he had received from Texas. Peters afterwards[4] showed that the specimen supposed to be from Mexico was a *Scapanus*. I have considered the species somewhat at length in another place (p. 58), and am disposed to regard it as identical with typical *S. townsendi*.

In 1848, Pomel took *S. townsendi* out of the genus *Scalops* and established the genus *Scapanus* for its reception.[5]

Somewhat later, in 1853, Cassin published a description of what appeared to be a very remarkable new species from a specimen, *Scalops æneus*, obtained in Oregon by the United States Exploring Expedition.[6] It appears from an examination of the type, however, that the striking peculiarities of the type specimen are due to its having been kept for a long time in a copper tank. The skull has disappeared, but there is little reason to doubt that the specimen is only a rather young *Scapanus townsendi*.

When describing *Scapanus townsendi*, Bachman had before him, as already stated, two specimens, one of which (Townsend's specimen) had an irregular white mark on the under side of the body. In 1854, Le Conte, thinking that he detected certain other peculiarities in this specimen, described it anew under the name of *Talpa taeniata*.[7] For

[1] Journ. Acad. Nat. Sci. Phila., VIII, pt. 1, 1839, p. 58.
[2] Boston Journ. Nat. Hist., IV, 1842, p. 32.
[3] Boston Journ. Nat. Hist., IV, 1842, p. 34.
[4] Monatsber. Berlin Akad. für 1863 (1861), p. 656.
[5] Archiv. Sci. Phys. et Nat., IX, 1848, p. 247.
[6] Proc. Acad. Nat. Sci. Phila., VI, 1853, p. 299.
[7] Proc. Acad. Nat. Sci. Phila., VI, 1853, p. 327.

this course, however, there does not seem to have been sufficient warrant, and the name should stand as a synonym of *S. townsendi*.

All the names thus far considered are to be regarded as synonyms of *S. townsendi*, but in 1855 Dr. W. O. Ayres described the mole which is found in the neighborhood of San Francisco, California, under the name of *Scalops californicus*.[1] This is a smaller and paler form than the typical Oregon mole, and is recognized as a distinct species, *S. californicus*, in this work. Whether a type specimen was preserved is uncertain, but about 1856 Dr. Ayres sent two specimens to the National Museum from San Francisco,[2] which may be regarded as typical.

Dr. J. A. Allen established a species under the name of *Scapanus anthonyi*, in 1893, from a specimen obtained in the San Pedro Martir Mountains of Lower California.[3]

The type remains unique, and until more specimens are collected from the same and other neighboring localities the relationships of the species can not be fully determined.

In 1894 I described, under the name of *S. dilatus*,[4] a supposed new species, characterized, like *S. anthonyi*, by the possession of one less upper premolar than the usual number, and some other minor features. This species was based on a skeleton from Fort Klamath, Oregon, belonging to Dr. C. H. Merriam. Afterwards, Dr. Merriam sent me two other specimens in alcohol, from the same locality. These had the normal number of premolars. Such being the case, I am disposed to regard the other characters given in the diagnosis as individual rather than specific, and to associate the Fort Klamath mole with *S. californicus*.

DESCRIPTION OF THE TYPE SPECIMEN OF SCALOPS AENEUS, CASSIN.

No. 3725, U.S.N.M., Oregon, U. S. Explor. Exped.

The type is a skin without a skull. It is in a good state of preservation except for its discoloration from immersion in impure alcohol.

From its small size and long claws, it may be judged to be a young individual. It measures as follows:

	mm.
Length of head and body	115.0
Length of tail	30.5
Length of fore foot (without claws)	14.0
Length of longest foreclaw	10.0
Length of hind foot (without claw)	21.5
Length of longest hind claw	4.5

REMARKS OF PROFESSOR PETERS ON THE TYPE SPECIMEN OF SCALOPS LATIMANUS, BACHMAN.

"6. *Scalops latimanus* Bachmann=*Sc. Townsendi* Bachman, Baird.

"Diese Art ist von Bachmann nach einem Exemplar des Berliner

[1] Proc. Cal. Acad. Nat. Sci., I, 1855, p. 54.

[2] Skeleton, No. 3111; alcoholic, No. 2673. The latter is mentioned by Baird.

[3] Bull. Amer. Mus. Nat. History, V. 1893, p. 200.

[4] Proc. U. S. Nat. Mus., 17, p. 242.

Museums aufgestellt worden, welches von Deppe angeblich aus Mexico eingesandt worden wäre. Das einzige Exemplar der Gattung *Scalops*, welches sich aber aus der Deppe'schen Sammlung im Berliner Museum (No. 712) befunden hat und befindet und welches, da ich es als '*Sc. latimanus* Bachmann' bezeichnet vorfand, ohne Zweifel das Originalexemplar der Bachmann'schen Art ist, stammt nicht aus Mexico, sondern ist, wie aus dem Eingangsjournal der Deppe'schen Sammlung hervorgeht, aus Monterey in Californien eingesandt und im October 1834 in Sta. Clara (Sonora?) gesammelt worden. Es gehört dieses Exemplar auch nicht zu der eigentlichen Gattung *Scalops*, sondern zu *Scapanus* Baird mit 44 Zähnen und stimmt nicht allein nach Baird's genauer Beschreibung, sondern auch nach Vergleichung mit einem zweiten Exemplar, welches wir Hrn. Dr. F. Jagor aus Californien verdanken, durchaus mit *Sc. Townsendi* überein. Es muss daher der *Sc. latimanus* aus der Liste der Säugethiere gestrichen werden."[1]

DESCRIPTION OF THE TYPE SPECIMEN OF SCAPANUS ANTHONYI, J. A. ALLEN.

No. $\frac{6303}{4947}$. Male. San Pedro Martir Mt., L. Cal. (altitude 7,000 ft., May 8, 1893). Collection of American Museum of Natural History.

This specimen is a well-prepared skin accompanied by a skull. The fur is rather dark and fresh-looking, giving the impression that it is the new summer pelage.

The skull has but three premolars above and below. The first premolar is apparently the one missing. Whether this difference is merely an individual peculiarity can not, of course, be determined until more specimens shall have been collected. The teeth are much worn, and the contour of the skull indicates that it is mature or old.

The dimensions of the skull are as follows:

	mm.
Total length	30.0
Basilar length	24.7
Palatal length	13.5
Mastoid breadth	15.7
Zygomatic breadth	12.8
Facial breadth	8.8
Breadth between I^1 and PM^3	4.6

[[1] Translation.]

"6. *Scalops latimanus* Bachman = *Sc. Townsendi* Bachman, Baird.

"This species was based by Bachman on a specimen in the Berlin Museum which had been forwarded by Deppe nominally from Mexico. The only specimen of the genus *Scalops*, however, from Deppe's collection which has been and is in the Berlin Museum, No. 712 (and which, as I found it marked as '*Sc. latimanus* Bachmann,' is doubtless the original specimen of Bachman's species), did not originate from Mexico, but was, as appears from the entry journal of Deppe's collection, transmitted from Monterey in California, and was collected in Santa Clara (Sonora?) in October, 1834. This specimen does not belong to the genus *Scalops* proper, but to *Scapanus* Baird, with 44 teeth, and agrees, not only according to Baird's exact description, but also according to a comparison with a second specimen from California, which we owe to Dr. F. Jagor, entirely with *Sc. Townsendi*. Hence the *Sc. latimanus* must be stricken out of the list of mammals." (Monatsher. K. Akad. Wissensch. Berlin, 1863, p. 656.)

The skin as now preserved has the following dimensions:

	mm.
Total length	124.0
Length of tail	28.5
Breadth of fore foot	12.5
Length of fore foot (without claw)	12.0
Length of hind foot (without claw)	15.5

Dimensions of skulls of Scapanus orarius.

Catalogue number.		Collection.	Locality.	Sex.	Total length.	Basilar length (Hensel).	Length of palate from in front of incisor.	Mastoid breadth.	Greatest zygomatic breadth.	Greatest facial breadth.	Interval between first upper incisor and last premolar.	Age.
Skull.	Skin.				*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
5208	4555	Merriam....	Port Townsend, Wash.	...	33.0	27.2	14.4	.....	12.6	9.2	5.8	Youngish.
		Miller	Sumas, British Columbia.									
43329	31464	Dept. Agric.	Steilacoom, Wash..	♂	32.6	26.6	14.1	16.0	13.0	9.5	5.6	Adult.
22650	.....	Nat. Mus ...	Myrtle Point, Oreg.	♀	33.7	27.6	14.6	16.5	12.6	9.5	6.0	Youngish.
36937	15065	Nat. Mus ...	Fort Walla Walla,	...	32.8	26.8	14.4	16.0	13.0	9.8	5.2	Do.

Dimensions of skulls of Scapanus townsendi.

					mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
6894	.....	Nat. Mus...	Simiahmoo, Wash..	...	40.5	.....	18.7	19.2	15.3	10.7	7.1	Adult.
42810	30918	Dept. Agric.	Sauk, Wash	...	41.2	35.0	18.2	19.6	15.4	11.6	7.4	Do.
43332	31467	.....do	Tenino, Wash	♀	41.2	34.0	18.7	19.2	16.0	11.3	7.1	Oldish.
43330	31465	.....do	.....do	♂	41.4	34.5	19.0	19.1	16 0	11.8	7.5	Adult.
43331	31466	.....do	.....do	...	41.0	34.2	18.0	19.7	15.8	11.7	7.2	Do.
66199	.....	.....do	Lake Cushman, Wash.	♂	40.7	34.0	19.0	19.4	15.6	11.9	7.3	Do.
66200	.....	.....do	.....do	♂	40.5	34.2	18.5	19.4	15.6	11.2	7.0	Do.
2050	1436	Merriam....	Skokomish, Wash..	...	39.2	32.4	18.2	18.5	15.4	11.0	7.3	Do.
56896	.....	Dept. Agric.	Oregon City, Oreg..	♂	41.5	34.6	19.0	20.0	16.2	12.0	7.5	Do.
56897	.....	.....do	.....do	♂	41.3	34.5	18.4	20.0	16.4	11.6	7.2	Do.
57140	.....	.....do	Beaverton, Oreg....	...	41.7	34.5	18.5	20.0	16.4	12.2	7.3	Do.
36525	21831	Nat. Mus ...	Salem, Oreg.....	...	39.0	.....	17.5	19.3	16.3	11.3	6.7	Do.
69400	.....	Dept. Agric.	Seaton, Oreg.....	♀	43.8	36.4	19.4	20.2	15.8	12.0	8.0	Old.
68150	.....	.....do	Crescent City, Cal .	♂	.....	.....	19.2	.....	16.6	10.6	8.0	Adult.

Dimensions of skulls of Scapanus californicus.

					mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
68149	.....	Dept. Agric.	Gualala, Cal.....	...	37.2	31.2	16.4	17.2	14.3	10.3	6.1	Adult, or less.
60148	.....	.....do	Cazadero, Cal	♀	37.2	30.5	16.4	17.3	.....	10.9	6.2	Adult.
548	1285	Amer. Mus .	Nicasio, Cal.....	♀	37.4	31.4	16.7	17.6	14.7	10.9	5.2	Old.
65195	.....	Dept. Agric.	.....do	♀	36.0	30.0	16.0	17.0	14.0	10.0	5.6	Do.
547	1284	Amer. Mus .	.....do	♂	37.4	31.0	16.2	17.3	14.8	10.4	5.7	Old, or less.
65193	.....	Dept. Agric.	.....do	♀	36.3	29.2	15.6	17.4	14.6	10.6	5.5	Do.
65194	.....	.....do	.....do	♂	37.0	30.0	16.2	17.2	14.6	10.4	5.5	Do.
3361	2731	Merriam....	.....do	♂	35.0	28.3	14.4	17.0	.....	10.2	6.4	Adult.
509	1080	Amer. Mus .	.....do	♀	36.4	30.0	15.6	17.3	14.1	10.6	5.4	Do.
65192	.....	Dept. Agric.	.....do	♀	37.5	30.8	16.4	17.0	14.4	10.0	6.2	Do.
65191	.....	.....do	.....do	♀	37.0	30.0	16.3	17.0	14.5	10.2	5.9	Do.
65189	.....	.....do	.....do	...	36.3	30.3	15.6	16.4	13.5	9.6	6.0	Adult, or less.
65187	.....	.....do	.....do	♂	36.0	29.5	15.5	17.0	14.0	10.0	5.8	Do.
35285	19877	Nat. Mus ...	.....do	♂	36.8	31.0	16.0	17.2	14.3	10.0	6.0	Do.
35286	19829	.....do	.....do	♀	34.5	29.5	15.4	17.6	14.4	10.0	5.6	Do.

Dimensions of skulls of Scapanus californicus—Continued.

Catalogue number.		Collection.	Locality.	Sex.	Total length.	Basilar length (Hensel).	Length of palate from in front of incisor.	Mastoid breadth.	Greatest zygomatic breadth.	Greatest facial breadth.	Interval between first upper incisor and last premolar.	Age.
Skull.	Skin.				mm.	mm.	mm.	mm.	mm.	mm.	mm.	
35128	19409	Nat. Mus ...	Nicasio, Cal.....	♂	37.0	28.6	16.0	17.4	14.0	10.6	5.3	Adult, or less.
3956	3291	Merriam....	.....do	♀	35.0	29.0	15.0	17.0	14.0	10.4	5.4	Do.
6130	5443	.....	....do	♀	36.3	31.8	15.6	17.6	14.7	10.8	5.4	Do.
3111	.....	Nat. Mus ...	San Francisco, Cal.	...	32.7	27.0	14.0	16.5	13.7	10.0	5.0	Adult.
48291	36047	Dept. Agric.	Pacific Grove, Cal..	♂	33.6	27.7	15.0	16.1	13.4	9.5	5.3	Youngish.
30299	.....	.....do	Alhambra, Cal.....	♂	30.0	.....	14.2	16.0	13 0	9.4	5.0	Adult.
30298	.....	.....do	.....do	♂	31.8	27.0	14.2	16.2	13.6	9.8	5.0	Adult, or less.
30300	.....	.....do	.....do	♂	30.3	25.4	13.3	15.2	12.6	9.2	4.8	Do.
61374	.....	Nat. Mus ...	.....do	♂	32.0	26.7	14.0	16.0	13.0	9.0	5.2	Do.
30406	.....	Dept. Agric.	.....do	♂	30 8	25.2	13.4	15.7	13.0	9.3	5.0	Youngish.
30411	.....	.....do	.....do	♂	31.7	26.7	14.2	15.8	12.9	9.1	5.1	Do.
30310	.....	.....do	San Gabriel, Cal ...	♂	32.0	26.1	13.4	15.3	13.0	9.0	4.8	Adult, or less.
2746	2230	Merriam....	San Bernardino, Cal	♂	30.6	25.0	13.0	15.7	13.0	9.4	4.8	Do.
56533	.....	Dept. Agric.	San Bernardino Peak, Cal.	♂	32.3	26.8	14.0	16.3	13.5	9.7	4.6	Old.
66597	.....	.....do	Tehachapi Peak, Cal.	♂	.....	27.3	14.4	16.6	13.7	10.0	5.4	Adult, or less.
41243	.....	.....do	Owens Lake, Cal...	♀	31.6	25.6	13.7	15.8	13.2	9.6	4.9	Do.
40943	.....	.....do	.....do	♀	31.0	24.4	13.4	15.4	12.5	9.4	4.9	Youngish.
23967	.....	.....do	Bijou, Cal.....	...	.....	.....	15.0	.....	.....	9.6	5.8	(Broken.)
	11243	Nat. Mus ...	Fort Crook, Cal.....	...	33.8	27.5	.....	16.9	14.0	10.0	5.4	Youngish.
36886	14475	.....do	Baird, Cal.....	...	.....	.....	15.4	16.9	.....	9.5	5.8	Do.
*1286	.....	Merriam....	Fort Klamath, Oreg	...	34.4	28.4	15.0	17.0	14.0	10.6	5.6	Adult.

*Type of *S. dilatus*.

Dimensions of type skull of Scapanus anthonyi.

4947	6313	Amer. Mus.	San Pedro Martir Mountains, Lower California.	♂	30.0	24.7	13.5	15.7	12.8	8.8	4.6	Adult.

Genus PARASCALOPS, True.

Parascalops, TRUE, Proc. U. S. Nat. Mus., XVII, 1894, p. 242. (Type: *Scalops breweri*, Bachman.)

Body fusiform. Head conical. Nostrils lateral. Fore feet very broad, talpoid. Tail thick and hairy. Eyes minute. Auricular orifice large. Skull depressed; tympanic bullæ annular. Molars with a broad, trilobed internal basal lobe. Pelvis with no osseous bridges connecting the sacrum with the ischium.

Dental formula: i, $\frac{3}{3}$; c, $\frac{1}{1}$; pm, $\frac{4}{4}$; m, $\frac{3}{3}$; total, 44.

From a detailed comparison of the skeletons of *Scalops aquaticus*, *Scapanus townsendi*, and *Scapanus breweri* (or *americanus*) I arrived at the conclusion that the last two can not properly be included in the same genus, and that Townsend's mole really has a much closer affinity

with *S. aquaticus* than with *S. breweri*. In an earlier paper I separated Brewer's mole under the generic name of *Parascalops*.[1]

The characters which I rely on in making this redivision are to be found in the pelvis, the tympanic bullæ, and the teeth. Upon comparing the pelvis of the three species mentioned, it will be observed that in *Scalops aquaticus* and *Scapanus townsendi* the lateral processes of the sacral vertebræ have united with the ischium in two places, the first opposite the acetabulum and the second more posteriorly. In front of the first bridge on either side is a large oval vacuity or foramen. In addition the spines of the sacral vertebræ in these two species are completely anchylosed together, forming one continuous ridge of bone (as shown in fig. 1).

Turning to *Parascalops breweri* we find that the sacral vertebræ have no osseous connection with the pelvis posterior to the acetabula, and further that the neural spines, though connected at their extremities by a continuous bar of bone, have vacuities between them, so that the several vertebræ are readily distinguishable.

In *Scalops aquaticus* and *Scapanus townsendi* the tympanic bullæ are complete, and end externally in a small but well formed bony meatus. Quite different conditions obtain in *Parascalops breweri*, in which the bullæ are irregularly annular and do not conceal the tympanum or form a meatus.

Finally, in *Scalops aquaticus* and *Scapanus townsendi* the crowns of the molar teeth consist of two large V-shaped external cusps, with a simple internal basal projection surrounding the internal edge of the anterior one.

In *P. breweri* the basal projection is trilobed and bounds the inner edge of both external cusps.

On the basis of these characters alone it would be necessary to unite *S. aquaticus* and *S. townsendi* in the same genus *Scalops*.[2] But the dental formula of *S. aquaticus* (together with the relative size and position of the teeth) differs from that of *Scapanus townsendi*, and the genus should be retained.

PARASCALOPS BREWERI (Bachman).

BREWER'S MOLE; OR HAIRY-TAILED MOLE.

Scalops breweri, BACHMAN, Boston Journ. Nat. Hist., IV, 1842, p. 32.
Scapanus breweri, POMEL, Arch. Sci. Phys. et Nat., IX, 1848, p. 247.
Scapanus americanus, COUES, Amer. Nat., XIII, 1879, p. 189.
Parascalops breweri, TRUE, Proc. U. S. Nat. Mus., XVII, 1894, p. 242.

Size moderate (average length about 177 mm.). Snout acute; nostrils lateral, crescentic. Auricular orifice large, about 3.5 mm. in diameter.

[1] Proc. U. S. Nat. Mus., XVII, 1894, p. 242.

[2] See the statement of Flower and Lydekker: "The right [of *Scapanus*] to generic distinction is doubtful." (Mammals, p. 630.)

Tail short, very thick, blunt, densely hairy and constricted at the base. Toes not webbed.

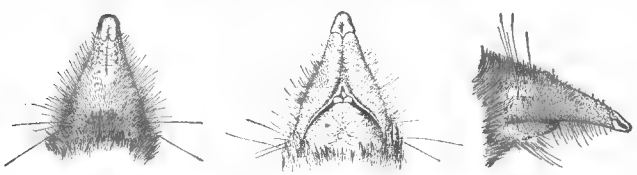
Color dusky brown, paler and grayer below. Hairs of the feet, tail, and snout brown, changing with age to white.

Average dimensions (10 adults from Magnetic City, North Carolina): Length of head and body, 146.9 mm.; tail vertebræ, 30 mm.; hind foot, 19 mm.

Average dimension of skull (20 adults): Total length, 32.2 mm.; mastoid breadth, 14.7 mm.; length of superior tooth row, 13.6 mm.

DESCRIPTION.

Body fusiform. Legs enveloped in the integuments nearly to the wrists and ankles. Head depressed and triangular, produced into a conical snout. Snout extending about 9 mm. beyond the incisor teeth;

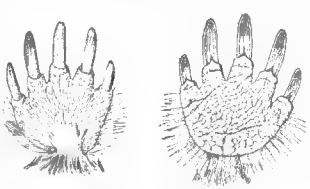


19. 20. 21.

SNOUT OF PARASCALOPS BREWERI.

Fig. 19, Upper surface. Fig. 20, Lower surface. Fig. 21, Side view.
(1½ times natural size.)

naked above, furnished on the sides with warts, of which there are three or four on each side of the median line. Mystacial bristles prominent, the extremities of the longest extending to a point between the eyes and auricular orifice. Nostrils terminal, subcrescentic, situated on the sides of a fleshy, granular pad. Upper lip thin and ridge-like, as in *Scalops aquaticus;* emarginate in front and joined to a narrow, triangular, naked area, which runs the length of the snout inferiorly. The median line of the lower jaw also naked.



22. 23.

FORE FOOT OF PARASCALOPS BREWERI.

Fig. 22, Upper surface. Fig. 23, Lower surface.
(1½ times natural size.)

Front feet very broad, depressed; their length (without the claws) about equal to their breadth. Upper surface sparsely covered with rather long hairs, which form a prominent fringe posteriorly; the last joint of the digits naked. Inferior surface naked throughout and granular. Toes very short, subequal, not webbed. Second, third, and

fourth claws subequal and longest; first and fifth, equal and much shorter. Claws long, thick, blunt; convex above, flat or concave below.

Hind feet narrow, about three times as long as broad; their length exceeding that of the fore feet. Upper surface hairy; sole obtusely granular, with one well-defined tubercle about in the middle of their length.

Toes short, subequal, the first and fifth much farther back than the other three and with shorter claws. Claws compressed and pointed.

24. 25.

HIND FOOT OF PARASCALOPS BREWERI.

Fig. 24, Lower surface. Fig. 25, Upper surface.

(1½ times natural size.)

26.

TAIL OF PARASCALOPS BREWERI.

(Natural size.)

Tail two-thirds the length of the head, thick, cylindrical, constricted at the base and well clothed with long hairs, which nearly conceal the skin.

Eyes concealed in the fur, minute, and covered by membrane. No external ear; auditory orifice comparatively large (about 3.5 mm. long); much larger than in *Scalops aquaticus;* oblong, with the long axis directed obliquely downward anteriorly.

Character of the fur as in *Scalops aquaticus.* General color dark brown, with grayish and silvery reflections; darker and browner than in *Scalops aquaticus.* Under surfaces a little lighter than the upper surfaces. Tail, backs of feet, and base of snout dark brown, changing with age to mingled brown and white, and finally to pure white. Claws, pale.

Young, silvery gray, with dusky feet and tail.

Adult males with a more or less pronounced rusty suffusion around the wrists and at the extremity of the lower jaw.

SKULL.

Skull depressed and conical. Occipital broad, well advanced on the upper surface of the skull. Parietal very large and broad, triangular, more or less acute anteriorly. Frontals convex, narrowed anteriorly, and extending a considerable distance along the nasals, but not joining the premaxillæ; their lateral extensions form almost the entire anterior part of the orbital region. Nasals elongated, wedge-shaped; their posterior half extending backward between the frontals, almost to the parietals; anterior extremities obliquely truncated and overlaid by the premaxillæ so as to appear very narrow in adult skulls. Lachrymal linear. Palatal surface of maxillæ concave, with a sagittal median groove. Palate emarginate behind, terminating opposite the last molar. Pterygoid process small. Basisphenoid inflated. Tympanics annular. Zygomatic arch slender, directed obliquely upward posteriorly.

Infraorbital foramen large, bounded posteriorly by a very slight bar of bone. Lachrymal foramen large, situated in front of and above the infraorbital. Horizontal ramus of mandible curved upward anteriorly and downward posteriorly. Coronoid process quadrate, with straight posterior margin. Angle similar but smaller.

TEETH.

Dental formula: i, $\frac{3}{3}$; c, $\frac{1}{1}$; pm, $\frac{4}{4}$; m, $\frac{3}{3}$; total, 44.

First superior incisor very large, broad, and flattish; somewhat inclined inward and connivent at the inner angle, notched in the middle and furnished with a small but distinct external accessory cusp. Second and third incisors, canine, and first and second premolars simple, conical, slightly curved, and compressed. Third premolar similar, but with a small compressed posterior accessory cusp. The canine is the largest of these simple teeth and the first premolar the smallest; the second and third premolars are successively larger. The second and third incisors are similar, but the third is larger than the second. The fourth premolar is large, triangular, compressed, with a small anterior accessory cusp, a posterior trenchant margin terminating in a basal tubercle, and an internal basal cusp, or heel, which is bifid. The first molar is largest, the second intermediate, and the third smallest. They are furnished with large W-shaped external cusps as in the other genera and a prominent internal basal ledge, which is trilobed (or quadrilobed in the first molar). In the last molar the posterior portion of the external cusp is aborted.

The first lower incisor is similar to the upper one but smaller. The six succeeding teeth—namely, the second and third incisors, the canine, and the first, second, and third premolars—are simple and conical. All are subequal except the second incisor, which is larger and canine-like with an anterior trenchant margin. The premolars have obsolete basal tubercles. The fourth premolar is similar to the others, but furnished with more conspicuous anterior and posterior tubercles and a similar internal one. The first and second molars are equal in size and the third about one-third smaller. The are W-shaped in transverse section.

The internal cusps are very prominent. The first molar has a distinct postero-internal basal tubercle, and the second molar similar tubercles both anteriorly and posteriorly. The anterior internal cusp of the first molar is bilobed.

SKELETON.

The vertebral formula of *Parascalops breweri*, as determined from a skeleton in the National Museum collection, and two others in the collection of Dr. Merriam, is as follows: c, 7; d, 13; l, 6; s, 6; ca, 13; total, 45. The last caudal is rudimentary.

There are eight intervertebral ossicles, the most anterior of which is

between the last two dorsal vertebræ, and the most posterior between the last lumbar and first sacral.

The sternum comprises 6 segments including the manubrium. The latter is as long as the remaining segments combined, and has the facets for the first pair of ribs at the beginning of its posterior third. The keel is broad, especially anteriorly. The upper surface is broad in front of the ribs, and furnished with a median crest.

The humerus is about one-third longer than broad, while the clavicle is equally as long as broad.

The bones of the pelvis are approximated under the acetabula, but those of the two sides do not meet. The pubic bones are widely divergent posteriorly. The iliac bones are completely fused with the sacral vertebræ above, leaving only two small foramina on each side. The last sacral vertebra has a short broad transverse process (as in *Condylura*), which does not touch the pelvis.

In the manus the *os falciforme* is short and very broad at the base. Its distal end rests against the proximal end of the first metacarpal. The terminal phalanges are irregularly bifid.

Tibia one-sixth longer than the femur; the fibula uniting with it slightly above its middle point.

GEOGRAPHICAL DISTRIBUTION.

On the basis of the specimens and records examined, the range of the species may be stated to extend from the mountains of North Carolina and West Virginia and southeastern Ohio in a northeasterly direction across Pennsylvania, New Jersey, New York, and the New England States to New Brunswick. The northwestern boundary skirts Lake Erie and Lake Ontario and follows thence the St. Lawrence River to Quebec and perhaps to the ocean; but for want of definite records as regards New Brunswick, it must be deflected southward to follow the eastern boundary of Maine, with a slight inclination outward at Passamaquoddy Bay to include Charlotte County, New Brunswick.

The specimens examined are, with two exceptions, all from localities within the following boundaries: Beginning at Cleveland, Ohio, the line skirts the southern shore of Lake Erie and of Lake Ontario to a point near the exit of the St. Lawrence River; thence it passes across New York to Lake George; thence across extreme western Massachusetts to northwestern Connecticut; thence in a southwesterly direction across Pennsylvania to the vicinity of Pittsburg; and thence to the starting point, Cleveland, Ohio. The two outlying points from which specimens have been examined are Quebec, Canada, and Magnetic City, North Carolina, at the foot of Roan Mountain.

From the records the range, as indicated above from specimens, receives large extensions, chiefly toward the northeast. The North Carolina locality is connected with the main area through the record of Audubon and Bachman. They report having seen one near Red Sulphur

Springs, West Virginia, and obtained specimens in western Virginia.[1] Mr. Bangs's collection contains several specimens from White Sulphur Springs, West Virginia. To the west, the next records which I have found are those of Langdon[2] and Brayton,[3] who report that a specimen was taken at Rome, in Adams County, Ohio, and that the species is not rare in that locality.

Mr. E. W. Vickers sent a specimen to the National Museum from Ellsworth, Ohio, and stated in a letter to me that he had also taken the species at Berea and Canton. He remarks:

> This mole seems to take the place of the common mole, *S. aquaticus* or *S. argentatus*, in the localities where I have lived—viz, Canton, Berea, and Ellsworth—for I have never taken a specimen of these species.

Dr. J. A. Allen mentions a specimen from Hollidaysburg, Pennsylvania, which is in the Museum of Comparative Zoology, Cambridge, Massachusetts. This locality is in Blair County, in the mountains near Altoona. There are no records of the occurrence of the species in eastern Pennsylvania, but Dr. Abbott mentioned it in 1868 among the mammals of New Jersey. He remarks that it "is much less abundant than the preceding [*Scalops aquaticus*], to which it bears a great resemblance."[4]

No specimens are referred to, and I know of none from the State in any museum. It would seem, therefore, that the occurrence of the species in New Jersey requires confirmation.

All the New York specimens examined were from Lewis and Oneida counties, in the northwestern part of the State, but Bachman had 4 specimens from Troy, Rensselaer County.[5] Baird remarks that the species "is in reality very abundantly to be met with in the northern part of the State, and apparently to the exclusion of the more southern species with white naked tail, *S. aquaticus*."[6] No specimens have been taken in any part of southern or southeastern New York, so far as I am aware.

The type of the species came from Marthas Vineyard, Massachusetts, and Dr. J. A. Allen mentions a specimen from Warwick, Franklin County, as being in the Museum of Comparative Zoology.[7] Dr. Coues records its occurrence at Somerset, in Bristol County.[8]

If there are any records of the occurrence of the species in Vermont or New Hampshire, they are unknown to me, but it is very probable that this mole is found there.

I have examined no specimens from Maine and know of but one

[1] Quadrupeds of North Amer., II, 1851, p. 175.

[2] Ohio Geol. Surv. Rept., IV, 1882, p. 93, 94.

[3] Journ. Cincin. Soc. Nat. Hist., III, 1880, p. 302.

[4] Geol. Surv. of New Jersey, 1868, p. 752.

[5] Aud. & Bach., Quad. of North Amer., II, p. 175.

[6] Fifteenth Rept. N. Y. State Cabinet of Nat. Hist., 1862, Appendix A.

[7] Bull. Mus. Comp. Zool., I, No. 8, 1869, p. 222.

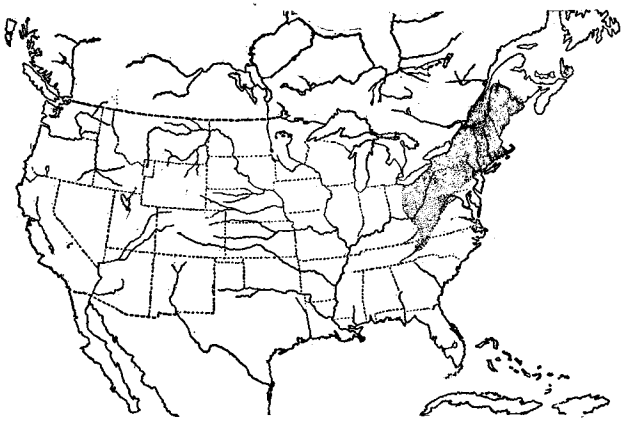
[8] Amer. Nat., XIV, 1880, p. 53.

mention of its occurrence in the State. This was at Upton, in Oxford County, near the western boundary.[1] It probably occurs, however, generally in the State.

Two writers affirm the existence of the species in New Brunswick—Tyrrell,[2] who mentions no localities, and Chamberlain,[3] who states one specimen was taken in Charlotte County in the extreme southwestern part of the Province.

VARIATION.

In the small series at hand, in which the majority of the specimens are from Locust Grove, Lewis County, New York, Ravenna, Ohio, and Magnetic City (foot of Roan Mountain), North Carolina, no appreciable geographical variation of color or size can be detected. A specimen



GEOGRAPHICAL DISTRIBUTION OF PARASCALOPS.

from Quebec is not different from the others, except that it is a little duller in color and browner, probably due to its having been in the collection for a long time.

There is, however, considerable variation with age. The feet, tail, and base of snout, which are dark brown in young individuals, become progressively more hoary with increasing age and are eventually pure white. In all the specimens in which the tail is hoary, the teeth are more or less worn, and sometimes very greatly. The specimen which shows this albinism most strongly (No. 510, Merr. Coll., Locust Grove, New York), has stronger ridges on the skull than any other in the series.

[1] In Museum of Comp. Zoology. See J. A. Allen. Bull. Mus. Comp. Zool., I, No. 8, 1869, p. 222.

[2] Proc. Canad. Inst., 3 ser, VI, 1888, p. 89.

[3] Bull. Nat. Hist. Soc. New Brunswick, X, 1892, p. 32.

This specimen presents a very peculiar appearance, as it has the tail entirely white, whitish feet, and a white band around the base of the snout, while the body is of the usual dusky color.

The specimens from North Carolina exhibit this hoariness less strongly, but few of them show indications of age. The individuals from Ohio show the variation no less than the others, so that it is quite certain that the change is not local.

Many adult males show a rusty color on the under surfaces, especially on the breast and throat, and also around the wrists. These specimens remind one of the series of *Scalops aquaticus texanus* from Rockport, Aransas County, Texas, in which a similar suffusion is strongly pronounced. The white spots in the fur, mentioned by Professor Baird,[1] are to be found on the older individuals.

Of the thirty-two skins from Magnetic City, North Carolina, three have small areas of pure white hair on the breast. Two of these specimens are females and the third a male. This last has a longitudinal white mark on the median line of the muzzle, which ends abruptly in a small orange-colored spot; the white on the breast in this instance is followed by an area of dull orange-brown; in fact, the base of the hair all around the white area is of this color.

MOLTING.

I have been able to make out very little regarding the shedding of the fur in this species from the series of about fifty specimens at command. Only three specimens show indications of shedding, and the condition of the fur in these three is puzzling.

In one (No. 66297, D. A., male), obtained at Magnetic City, North Carolina, March 26, 1894, the new fur covers the under surfaces of the animal completely, while on the upper side of the body the new fur is starting on the posterior half of the back, but is still concealed in the old fur. In the second specimen (No. 66298, D. A., male), obtained at the same locality as the first about a month later, namely, on April 24, the new fur has attained about half its full length over the whole of the lower surfaces and on the posterior half of the back, but it is still everywhere concealed by the old fur. The third specimen (No. 53823, D. A., male), obtained at the same locality as the last, about three weeks later, but in the preceding year (May 16, 1893), shows only a very small patch of new hair on the crown of the head, and there is a small amount of concealed new hair immediately around this area. There is besides a band of new hair visible on the breast; elsewhere the old hair still prevails.

As the specimens are all males, it is difficult to understand why the one taken latest shows the least advance toward a change. As regards this one, since it was taken in a different year from the other two, it may be supposed that the spring that year was less advanced than in

[1] Mammals of North America, p. 68.

1894, but this will not affect the two taken in the latter year. More specimens will be needed before the exact dates of molting can be ascertained.[1]

HISTORY OF PARASCALOPS BREWERI.

This species was first made known by Bachman in 1842,[2] under the name of *Scalops breweri*. Afterwards, in 1848, it was transferred by Pomel[3] to his genus *Scapanus* and two years ago I made it the type of a separate genus, which I named *Parascalops*.[4]

In 1879, Dr. Coues recommended the use of the name *Scapanus americanus*[5] for the species, on the ground that Harlan, in his Fauna Americana,[6] published in 1825, employed at the head of a description, which he (Dr. Coues) thought applicable to the present species, the name "*Talpa americana*," derived from a manuscript of William Barton. This view is untenable, however, because Harlan's description is wholly a translation, word for word and paragraph for paragraph, of Desmarest's description of *Talpa europæa*,[7] with only a word or a sentence here and there omitted. Even the measurements are included. It is evident, therefore, that Harlan copied nothing from Barton's manuscript, and that the latter's name is a *nomen nudum*.

In support of his position Dr. Coues cites the remark of Audubon and Bachman that "Harlan had described the skull of the species we have since described and figured as *Scalops Breweri*, having forty-four teeth."[8] These authors were deceived, however, for Harlan's description of the skull in question is a literal translation of Desmarest's description of skull characters of the genus *Talpa*.

There were specimens of Brewer's mole in the Museum of the Zoological Society of London prior to 1829. Richardson knew of their existence, but thought that they were "true moles"—that is, representatives of the genus *Talpa*.[9] Audubon and Bachman examined them at a later date and found that they were specimens of Brewer's mole.[10]

[1] In Mr. Bangs's collection a male taken at White Sulphur Springs, West Virginia, April 29, has the new fur on all the lower surfaces except the posterior part of the abdomen, while on the rest of the body the old fur is still in place with the new concealed under it. A young male taken at the same place May 31 has all summer fur.

[2] Boston Journ. Nat. Hist., IV, 1842, p. 32.

[3] Arch. Sci. Phys. et Nat., IX, 1848, p. 247.

[4] Proc. U. S. Nat. Mus., XVII, 1894, p. 242.

[5] Amer. Nat., XIII, 1879, pp. 189–190.

[6] Page 43.

[7] Mammalogie, pt. 1, 1820, p. 160.

[8] Audubon & Bachman, Quadrupeds of North America, III, 1854, p. 219.

[9] Richardson, Fauna Bor. Amer. Mam., 1829, p. 12. These specimens are probably Nos. 163*c* and 143*d*, marked *Talpa europæa* with a query in Waterhouse's Cat. Mus. Zool. Soc. London, 1838, p. 16. They were presented by Joshua Brookes.

[10] Audubon & Bachman, Quad. North Amer., III, p. 254. See also Godman, Amer. Nat. Hist., I, 1831, p. 106, footnote.

Dimensions of skulls of Parascalops breweri.

Catalogue number.		Collection.	Locality.	Sex.	Total length.	Basilar length (Hensel).	Length of palate from inside of first incisor.	Mastoid breadth.	Greatest zygomatic breadth.	Length of superior tooth row.	Coronoid process of mandible to angle.	Age.
Skull.	Skin.											
					mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
47684	35419	Dept. Agric	Lake George, N. Y.	♀	29.9	24.6	.....	14.0	11.2	12.9	9.6	Young.
232	.....	Merriam	Leyden, N. Y	...	33.5	28.0	12.8	15.0	12.5	14.2	....	Do.
1232	.....	....do	LocustGrove, N. Y.	...	32.5	.....	13.0	.....	.....	13.6	10.4	Youngish.
1007	.....	....do	....do	♂	32.3	28.0	13.4	15.0	12.0	13.8	10.6	Adult.
1160	.....	....do	....do	♂	32.4	27.4	13.0	15.0	12.4	14.0	10.4	Do.
1013	.....	....do	....do	♀	31.8	27.0	12.8	15.0	12.3	13.7	10.4	Do.
1002	.....	....do	....do	♂	31.5	26.2	12.0	14.6	11.9	13.3	10.4	Do.
1769	319	Nat. Mus ...	Cleveland, Ohio....	...	33.0	27.6	13.7	15.0	12.2	14.2	10.2	Adult, or old.
848	1670	Amer. Mus.	Ravenna, Ohio.....	♂	33.4	28.6	13.6	14.5	12.3	14.3	.....	Do.
851	1673	....do	....do	♂	32.9	27.5	13.4	14.6	12.3	14.0	10.4	Adult.
850	1672	....do	....do	♀	32.5	27.4	13.0	14.5	12.0	14.0	9.8	Adult, or less.
849	1671	....do	....do	♀	32.0	27.5	13.3	15.0	.....	14.0	10.0	Adult.
54091	.....	Dept. Agric	Magnetic City, N.C.	♂	33.7	28.1	13.2	15.2	12.5	14.1	10.5	Old.
54093	.....	....do	....do	♀	31.2	26.0	.....	14.5	12.0	13.2	9.8	Do.
50869	.....	....do	....do	...	32.0	27.0	13.3	15.0	11.8	13.5	10.5	Adult.
53823	.....	....do	....do	♂	33.0	27.6	13.5	15.0	12.3	14.0	10.0	Do.
53824	.....	.... do	....do	♂	32.7	27.1	12.8	15.0	12.0	13.6	10.0	Do.
53826	.....	....do	....do	♀	31.1	26.0	12.5	14.0	11.8	13.5	9.0	Do.
57088	.....	....do	....do	♂	31.0	26.0	12.4	14.1	.....	13.5	.....	Do.
54087	.....	....do	....do	♀	31.7	26.5	12.5	14.5	12.0	13.0	9.6	Do.
54088	.....	....do	....do	♂	32.0	26.9	12.4	14.7	12.0	13.3	9.9	Do.
54089	.....	....do	....do	♀	32.0	26.2	12.5	14.7	.....	13.1	9.5	Do.
54925	.....	....do	....do	♂	32.0	26.5	12.4	15.0	.....	13.0	10.0	Do.

Genus CONDYLURA, Illiger.

Condylura, ILLIGER, Prod. Syst. Mamm., 1811, p. 125. (Type *Sorex cristatus*, Linn.)

Scalops, FISCHER, Zoognosia, III, 1814, p. 156. (Type *Sorex cristatus*, L.)

Talpasorex, SCHINZ, Cuvier's Thierreich, IV, 1825 (†), p. 312 (fide Fischer). (Not *Talpasorex*, LESSON.)

Rhinaster, WAGLER, Nat. Syst. Amphib., 1830, p. 14.

Astromyctes, GRAY, List Mamm. Brit. Mus., 1843, pp. xxi and 76. (*Nomen nudum*, credited to Harris, who does not use it.)

Astromydes, BLYTH, Cat. Mamm. Asiat. Soc. Mus., 1863, p. 87.

Skull elongated. Interorbital constriction slight. Premaxillæ protruding. Anterior nares directed obliquely upward. Tympanic bullæ incomplete. Palate abbreviated posteriorly. Angular process of mandible linear.

Pelvis without osseous bridges behind the acetabulum. Caudal vertebræ numerous. Manubrium sterni moderate.

Dental formala i, $\frac{3}{3}$; c, $\frac{1}{1}$; pm, $\frac{4}{4}$; m, $\frac{3}{3}$; total, 44. Second upper and third lower incisors minute. Premolars tricuspidate. Molars with a broad tridentate internal basal ledge.

Nostrils anterior, surrounded by a series of large radiating tactile processes. Tail long and scaly. Fore feet broad, fossorial, furnished with an *os falciforme*. Hind feet elongate.

The genus *Condylura* is not closely allied to any other existing genus of moles, if osteological characters can be relied on. The peculiar

conformation of the skull and angle of the jaw, the form of premolar and incisor teeth, and the development of the nasal appendages are unique. Of American moles *Neürotrichus* is perhaps the nearest ally, but the gap between the two genera is considerable. In the form of the premolars we are reminded of *Talpa*, but there is no close resemblance otherwise.

In the modification of the fore limbs for fossorial purposes, *Condylura* does not reach the degree of specialization found in *Scalops* and *Talpa*. The humeri are relatively quite elongate, and the same is true of the clavicles, while the manubrium of the sternum is only moderately long. We owe the name *Condylura* to the faulty figure of the animal given by De La Faille, in which the tail is represented as constricted at intervals, the whole resembling a string of beads. From this Illiger was led to include in his diagnosis the expression "cauda mediocris nodosa," and to bestow an inappropriate name.

CONDYLURA CRISTATA (Linnæus).

STAR-NOSED MOLE.

Sorex cristatus, LINNÆUS, Syst. Nat., 10th ed., 1758, p. 53.
Talpa longicaudata, ERXLEBEN, Reg. Anim., 1777, p. 118.—SHAW, Gen. Zool. I, 1800, p. 523.
Talpa canadensis, DE LA FAILLE, Naturgesch. des Maulw., 1778, p. 3, t. 1 (fide Fischer).
Talpa cristata, KERR, Animal Kingdom, 1792, p. 201.
Talpa radiata, SHAW, Gen. Zool., Mamm., I, 1800, p. 523.
Sorex radiatus, SHAW, Gen. Zool., Mamm., I, 1800, p. 531.
Scalops cristatus, FISCHER, Zoognosia, III, 1814, p. 156.
Condylura cristata, DESMAREST, Journ. de Phys., LXXXIX, 1819, p. 230; Mammalogie, I, 1820, p. 157.
Condylura longicaudata, DESMAREST, Mammalogie, I, 1820, p. 158.
Condylura macroura, HARLAN, Fauna Americana, 1825, p. 36.
Rhinaster macrourus, WAGNER, Suppl. Schreber, Säugeth., II, 1841, p. 115.
Condylura prasinata, HARRIS, Boston Jour. Philos. and the Arts, II, 1825, p. 582.
Rhinaster cristatus, WAGLER, Nat. Syst. Amphib., 1830, p. 14.
Rhinaster longicaudatus, WAGNER, Suppl. Schreber Säugeth., II, 1841, p. 116.
Astromydes cristatus, BLYTH, Catal. Mamm. Asiat. Soc. Mus., 1863, p. 87. (Not seen.)[1]

Size moderate. Nasal cutaneous processes well developed, 22 in number, of which 18 are marginal and the remaining 2 pairs inserted on the nasal disk. Feet scaly. Fore feet fossorial, one-half as long as broad (including the claws). Eye comparatively large. Tail about three-fourths the length of the head and body, scaly, with scattered hairs; in winter, greatly enlarged, but with a constricted base.

Color above, dusky brown; below paler and grayer. Feet dusky. Tail indistinctly bicolored. A narrow ring of white at the wrist.

Average dimensions (6 fresh specimens, males and efmales, from Locust Grove, New York).—Total length, 202 mm.

[1] What is *Talpasorex* (*Condylura*) *fissipes*? in Minding's Geog. Vertheilung der Säugeth., 1829, p. 64?

Average dimensions (21 alcoholic specimens, males and females).—Total length, 170 mm.; tail vertebræ, 71.8 mm.; hind foot and claw, 27.1 mm.

Average dimensions of skulls.

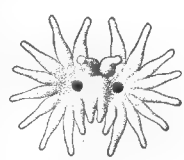
	mm.
Greatest length (9)	35.2
Basilar length (Hensel) (10)	27.6
Greatest zygomatic breadth (7)	10.2
Palate length (10)	13.5
Length of upper tooth row (base of crowns) (11)	15.2
Breadth of postorbital constriction (11)	7.1
Length of mandible, from inner base of incisors to end of angular process (11)	21.8

Type locality.—Pennsylvania.

Geographical distribution.—Rupert House and Moose Factory (Hudson Bay), Quebec, Ontario, and Manitoba on the north, southward to Minnesota on the west, to Virginia on the Atlantic Coast, and in the Alleghany Mountains to the boundary of South Carolina.

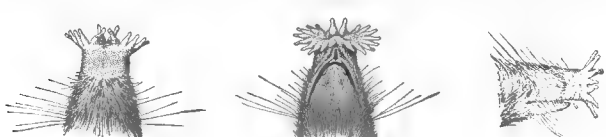
DESCRIPTION.

Form robust. Legs short. Snout broad and only moderately elongated, extended about 7 mm. beyond the anterior upper incisors in adults. Nostrils circular, opening forward on the surface of a naked disk, which is surrounded by a fringe of 22 naked lanceolate processes about 4.5 mm. long. These processes are symmetrically arranged, 11 on each side of the median line. Those forming the inner pairs above and below the nostrils are smaller than the others and have their origin on the anterior face of the disk rather than on its margin. The upper surface of the snout is naked as far backward as the point reached by the extremity of the nasal processes when laid back upon it.



27.
NASAL DISK OF CONDYLURA.
(Twice natural size.)

Corner of the mouth anterior to the line of the eyes. Upper lip grooved in the median line below the nasal disk. Inside its margin a



28. 29. 30.
SNOUT OF CONDYLURA CRISTATA.
Fig. 28, Upper surface. Fig. 29, Lower surface. Fig. 30, Side view.
(Natural size.)

thin ridge extends from the median line nearly to the corner of the mouth. Lower jaw naked at the extremity.

Eyes large for a member of this family (1½ mm.), deep sunk, partially covered by the thick lids posteriorly and concealed by the dense fur. (Not visible in dry skins, but may be found by parting the fur.)

Ear-conch wanting. Auricular aperture situated above the line of fore leg; large, irregular in outline, elongate, its long axis directed obliquely downward anteriorly. It has a broad internal projection below, and a small separate *cul de sac* at the posterior end. The aperture is entirely concealed by the fur, but its position is indicated by a slight depression.

31. 32.

FORE FOOT OF CONDYLURA.

Fig. 31, Lower surface. Fig. 32, Upper surface.
(Natural size.)

Fore feet large, but less so than in *Scalops*. Their breadth almost exactly one half their length (including the claw). Palms naked, covered with moderate-sized rounded scales. Outer (or upper) edge of the second, third, and fourth toes with three conspicuous flattish triangular tubercles; the first toe with two, the fifth with none. Backs of the hands covered with moderate-sized polygonal scales; those on the toes larger and somewhat symmetrically arranged.

33. 34.

HIND FOOT OF CONDYLURA.

Fig. 33, Lower surface. Fig. 34, Upper surface.
(Natural size.)

First toe shortest; the second, third, and fourth progressively longer; the fifth about as long as the third. Claws depressed, broad, obliquely set; slightly concave below, except at the tip. Marked on the upper surface with inconspicuous longitudinal furrows. A single row of long, rather stiff hairs surrounds the palms, and there are two hairs only at the inner edge of the base of each claw.

35.

TAIL OF CONDYLURA.
(⅔ natural size.)

The hind feet are one-fourth longer than the fore feet, narrow, scaly. Claws long, compressed. A large depressed tubercle at the base of the hallux. Toes naked (except that there are a few hairs at the base of the claws); metatarsus hairy only on the outer portion of the upper surface.

Tail in adults thick, conical, depressed (sometimes terete), with a slender base; covered with small scales in regular rows, from the distal margin of each of which three hairs project. These hairs are everywhere equally distributed, and are sufficiently numerous to partially conceal the scales.

Fur long, dense, and shining, coarser than in other American moles; consisting of two kinds of hairs, (1) a long, fine, crenulate under fur with enlarged tips, and (2) still longer, straight hairs, also with enlarged and tapering extremities, which in adults are generally more or less curved.

Color above rich, dusky brown; on the sides paler; on the under surfaces still paler and tinged with gray; young more reddish brown throughout; hairs dark plumbeous, except at the extremities; those on the face and chin in adults often nearly pure white; a ring of pure white fur around the wrist, the ankle, and the eye. Tail colored like the body, dusky above and slightly paler below, with paler or commonly white hairs on the under side at the tip or sometimes entirely white tipped. Backs of the fore and hind feet dusky. Fringe of the manus sordid white. Whiskers dusky. Claws pale.

Mammæ 4 pairs, 2 pairs inguinal and 2 pairs pectoral.

SKULL.

Facial portion long and narrow. Anterior nares directed obliquely upward. Premaxillæ extending much beyond the nasals anteriorly; the anterior half of the facial portion horizontal and the posterior half rising nearly at a right angle and meeting the nasals in their anterior fifth. Nasals terminating anteriorly in an acute point in adults, but truncate in the young; their sides parallel in the anterior half, but meeting in a very acute angle posteriorly where the nasals are inserted between the deflected borders of the frontals. Parietals irregularly triangular, emarginate on the median line anteriorly. Squamosal with a broad prolongation behind the tympanic bulla. Zygomatic arch short, straight, directed obliquely upward posteriorly. The squamosal supplies only a short portion of the posterior end of the arch, the remainder being apparently composed entirely of the zygomatic process of the maxillary. No malar can be detected even in the youngest skulls. The maxillary throws out a slender process which bridges over and confines the infraorbital foramen, and the distal end of this process is dilated and abuts against the posterior end of the lachrymals and also touches the neighboring margin of the frontal. The lachrymal is large, oval in shape, and lies on the face of the frontal. Foramen magnum large and oval, about twice as long as broad. Tympanic bullæ incomplete behind and overlaid internally by the basisphenoid. Palate short, emarginate behind, exposing the ethmoid and vomer.

Mandible with a slender horizontal ramus. Coronoid process large, erect, rather broad, and only moderately uncinate. A slight projection below the condyle on the posterior margin of the ascending ramus. Angular process long and slender as in the shrews, moderately dilated at the proximal extremity. It is slightly bent inward, and twisted upon itself so that the outer surface looks obliquely downward and the inner surface obliquely upward.

TEETH.

Dental formula: i., $\frac{2}{3}$; c., $\frac{1}{1}$; pm., $\frac{4}{4}$; m., $\frac{3}{3}$; total, 44.

First upper incisors large, half ovate, curved inward and touching each other only at the extremities. Second incisor linear, minute. Third incisor long and slender, with a small posterior basal tubercle, disappearing with age.

The canine is the smallest tooth in the row, except the second incisor. It is conical, compressed, with a small posterior basal cusp. The first, second, and third premolars similar to each other in form, but successively larger; the first with a posterior, and the second and third with both anterior and posterior basal tubercles, of which the posterior is the larger. Fourth premolar larger, with a small anterior basal tubercle, a posterior trenchant margin, and a large heel or internal basal cusp. Molars broad W-shaped in transverse section, with a broad internal basal ledge, extending entirely across the inner side of the tooth and having a tricuspidate free border. The points in which the lines meet to form the letter W, as well as the extremities, are elevated into cusps or tubercle-like thickenings, of which the inner are much the most prominent. The first molar has a small anterior basal tubercle. The third is smaller than the other two and irregularly triangular, lacking the portion corresponding to the posterior fourth of the second molar.

First lower incisor large, nearly spatulate in form, and inclined forward, so as to be horizontal. Second similar in form and position, but smaller. Third minute, with a sickle-shaped crown, and also inclined forward. Canine long, slender, and curved, with both anterior and posterior basal tubercles, of which the posterior is the larger. First premolar similar to the canine, but smaller. Second, third, and fourth premolars successively a little larger than the first and similar in form, but with a reduced central cusp and enlarged anterior and posterior basal tubercles. Between the central cusp and posterior tubercle and somewhat internal to them is placed an additional low tubercle. Molars compressed, W-shaped in transverse section, with cusps at the points representing the intersection of the lines and arms of the letter, of which cusps the external ones are much the largest and longest. The central inner one is bifurcated.

SKELETON.

In Cuvier's Leçons d'anatomie comparée the vertebral formula for *Condylura* is given as follows:

C., 7; d., 13; l., 6; s., 5; ca., 17; total, 48.

Bell[1] gives the same formula, having perhaps copied it from Cuvier. In two skeletons in the Museum collection I find the following:

C., 7; d., 13; l., 6; s., 5; ca., 19; total, 50. The last caudal is rudimentary.

[1] In Todd's Cyclopedia, Article *Insectivora*.

The intervertebral ossicles are well developed. The sternum consists of five segments, including the manubrium, which is as long as the other segments combined. It has a deep keel and short lateral processes near the anterior end for the articulation of the first pair of ribs.

The scapula is very narrow, with the infra-spinous fossa obsolete, the acromion prominent and moderately uncinate.

The humerus is one and one-half times as long as broad, and the clavicle nearly twice as long as broad, hence much less compressed than in *Scalops*.

The pelvis is contracted, but the iliac bones do not quite meet below the acetabula. There is no pubic symphysis. The sacrals dip downward behind the line of the acetabula and there is no osseous connection between them and the ischium.

The tibia is as long as the foot (including the claws) and one and two-thirds times as long as the femur. The fibula united with it above its middle point.

The terminal phalanges of the manus are bifurcated. The *os falciforme* is prominent and its distal extremity rests against a sesamoid at the outer base of the first metacarpal.

GEOGRAPHICAL DISTRIBUTION.

The range of the star-nosed mole covers an area extending on the Atlantic Coast from New Jersey to the mouth of the St. Lawrence River, and thence westward (with the northern limit at 51° N. lat.) to James Bay, Manitoba and Minnesota, and southward (in the mountains) to the boundary of South Carolina. The existence of the species in the Indian Territory and on the Pacific Coast is doubtful.

The latest monographer of the insectivora, Dr. G. E. Dobson, gives the range of the species as follows:

> North America, widely distributed, from Nova Scotia and Hudson Bay to South Carolina and northern Tennessee, extending westward through the States to Oregon and Washington Territory.[1]

I am unable as indicated above to trace the species through so wide an area, either from the specimens examined or from the records in literature. The specimens examined in the preparation of this work were from an area covering practically the whole of the New England and Middle States, with outlying localities in the Hudson Bay region, Nova Scotia, Quebec, the mountains of North Carolina, and finally Minnesota. The boundaries of the area referred to are somewhat as follows: On the south, beginning at Washington City, and Marshall Hall, Maryland, the line extends to Cleveland, Ohio; from thence along the Lakes to Ottawa, Canada; thence through Montreal to Eastport, Maine. The southeastern boundary extends from Washington to New York, thus excluding southern and eastern Maryland, Delaware, southern New Jersey, Long Island, and southern Connecticut. The outlying points

[1] Monogr. of the Insectivora, pt. 2, 1883, p. 133.

are as follows: In North Carolina, Roan Mountain; in Minnesota, Fort Ripley and Elk River; in the Hudson Bay territory, Moose Factory and Rupert House;[1] in Quebec, Godbout (about 180 miles east of the Saguenay River); in Nova Scotia, Halifax.

If a line were drawn connecting the outlying points above mentioned, it would roughly indicate the range of the species, as recorded in the literature, except in one or two directions to be mentioned presently. The range as thus indicated extends on the north to New Brunswick, James Bay, and Manitoba, on the west to Minnesota, Iowa, and Illinois, and on the south to Tennessee and North Carolina.

Audubon and Bachman sum up their knowledge of the distribution of the species as follows:

> This species is found sparingly in all the Northern and Eastern States. Dr. Richardson supposes it to exist as far north as Lake Superior. We obtained a specimen 5 miles from the Falls of Niagara, on the Canada side, and have traced it in all the New England States. We received specimens from Dr. Brewer, obtained near Boston, and from W. O. Ayres, esq., from Long Island. We caught a few of these animals near New York, and obtained others from various parts of the State. We saw a specimen at York, Pa., and found another at Frankfort, east of Philadelphia. We captured one in the valleys of the Virginia Mountains, near the Red Sulphur Springs [West Virginia], and received another from the valleys in the mountains of North Carolina, near the borders of South Carolina, and presume it may follow the valleys of the Alleghany ridge as far to the south as those latitudes. We have never found it in South Carolina or Georgia, but to the west we have traced it in Ohio and the northern parts of Tennessee.[2]

A Canadian writer, Mr. R. Bell, gives the species as common at Moose Factory, James Bay.[3] Richardson had several specimens supposed to be from Moose Factory, but he doubts that they were really from that locality. He writes on this point as follows:

> As the most southern fur posts depending upon Moose Factory are situated upon the borders of Lake Superior, it is probable that they [the "Moose Factory" specimens] came from that quarter.[4]

Whatever may be the truth as regards Richardson's specimens, the fact of the occurrence of the species at Moose Factory is established by specimen No. 15061 of the National Museum collection, which was received from Dr. Walton Hayden in 1881.

There was also in the National Museum prior to 1885 a specimen (No. 8901) received from B. R. Ross, of the Hudson Bay Company, who collected it at Rupert House in 1867.[5] There seems to be no reason to

[1] This specimen is no longer in the Museum. It was sent some years ago to Cambridge, England.

[2] Quad. of North America, II, 1851, p. 142.

[3] Canadian Geol. Survey, Montreal, 1884, 48 DD.

[4] Fauna Bor. Amer., p. 13.

[5] Rupert House is on James Bay, a little northeast of Moose Factory. The specimen, an alcoholic, was sent to the museum of Cambridge University, England, in 1885, where it is still presumably to be found. Two shrews were received with the mole.

doubt that this specimen actually came from Rupert House, which is the most northerly point at which the species has been found.

Couper records the presence of the species at Montreal, Canada, and also at the city of Quebec, where he says it is occasionally found.[1]

An anonymous writer in the Naturaliste Canadien cites it as occurring between the coast of Beaupré and the Ile d'Orleans,[2] which is in the St. Lawrence River, near Quebec.

The Department of Agriculture collection contains a specimen from much farther east, namely, at Godbout, on the north shore of the St. Lawrence, near its mouth and about 180 miles east of the Saguenay River.

In Nova Scotia and New Brunswick the species is common, according to Gilpin[3] and Chamberlain.[4]

The *Condylura prasinata* of Harris was described from a specimen from Machias, Me.,[5] and in the Sixth Report of the Board of Agriculture of Maine, it is also included among the mammals of that State.[6]

Zadock Thompson considered the species rare in Vermont. He captured two specimens in Burlington.[7]

In Massachusetts it was obtained in Essex County by Fowler,[8] and Emmons and Allen record it as common in the State, but the latter remarks that it is more numerous in the eastern part of the State than elsewhere.[9]

Linsley captured a specimen at Stratford in Connecticut,[10] but Morris regards it as not very common in that State.[11]

Dr. C. C. Abbott records the species from New Jersey, but remarks that it is not at all abundant, and that it is more frequently met with in the central than in the northern or southern sections of the State.[12]

Turning now to the West, I find that Kirtland, in 1838, had seen only one specimen in Ohio.[13] I have examined specimens from three localities in the northern part of the State—Cleveland, Garrettsville, and Ellsworth. A specimen has been sent to the Museum from the

[1] Forest and Stream, newspaper, VIII, p. 299.

[2] Nat. Canad., I, p. 146.

[3] Trans. Nova Scotia Inst., II, pt. 2, 1869, p. 59.

[4] Bull. Nat. Hist. Soc. New Brunswick, 10, 1892, p. 32.

[5] Boston Journ. Philos. and Arts, V, 1825, p. 580.

[6] Sixth Rept. Maine Board of Agric., p. 123. Dr. George P. Merrill, Curator of Geology in the U. S. National Museum, has very recently sent me a specimen from Auburn, Maine.

[7] History of Vermont, p. 28.

[8] Amer. Nat., IV, 1870, p. 761.

[9] Emmons, Quad. of Mass., 1840, p. XIX; Allen, Bull. Mus. Comp. Zool., I, No. 8, 1869, p. 222.

[10] Amer. Journ. Sci., XLIII, 1842, p. 347.

[11] Forest and Stream, newspaper, VI, 1876, p. 214.

[12] Geol. Survey of N. J., 1868, p. 752.

[13] Kirtland, List of Mammals of Ohio, 1838. Neither Langdon nor Brayton had personal knowledge of the occurrence of the star-nosed mole in Ohio.

last-mentioned locality by Mr. Ernest W. Vickers. Mr. Vickers wrote me in December, 1895, that the star-nosed mole was authoritatively known to occur in the following localities in Ohio: Cleveland and Berea, Cuyahoga County; Canton, Stark County; Cuyahoga Falls, Summit County; Suffield, Portage County; Weymouth, Medina County; Ellsworth, Mahoning County; Butler, Richland County;[1] New Philadelphia, Tuscarawas County.[2] He states that the last-mentioned locality is the most southerly point at which the species has been found in the State.

Mr. Charles Dury, secretary of the Cuvier Club of Cincinnati, in a letter dated January 4, 1896, has, however, furnished me the following information regarding the possible occurrence of *Condylura* near that city:

> There is one specimen of *Condylura cristata* in the Cuvier Club collection that was sent to us from Indiana, near the Ohio State line, a few miles north of due west from Cincinnati. This is the only specimen I have seen from the vicinity of this city. In twenty-five years' collecting in this vicinity I have never run across it myself. So it must be exceedingly rare here. I believe there are no specimens in the Natural History Society's collection.

The first specimen from Indiana, according to Evermann and Butler,[3] was obtained near Denver, Miami County. It was deposited in the museum of the Indiana Normal School and afterwards destroyed by fire. Another specimen was obtained near Deedsville, in Miami County, in 1894.

Prince Maximilian did not see anything of the species at New Harmony, on the southern boundary of Indiana, during his sojourn there in 1833. He remarks: "*Scalops canadensis* wirft überall Haufen auf, wie unser Maulwurf und ist sehr gemein, dagegen kommt hier *Condylura* nicht vor, die in Pennsylvanien gemein ist."[4]

Miles regarded the species as rare in Michigan in 1861, and had seen but one.[5] Tenney saw one at Niles, Berrien County, in 1869.[6] An anonymous writer in Forest and Stream newspaper, 1877, remarks: "Is rarely seen within the limits of the State [of Michigan], I believe, having seen but one specimen, and heard of but two more."

Messrs. Evermann and Butler, however, quote Prof. J. B. Steere as stating that the species is abundant at Ann Arbor, in low swampy ground which has been drained, and that he had taken it in Ionia County.

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[1] See Geol. Survey of Ohio, IV, p. 179, footnote.

[2] See his paper in the Third Annual Report of the Ohio State Academy of Science. His observations are also noted by Evermann and Butler in Proc. Indiana Acad. Sci., 1893, p. 134.

[3] Loc. cit.

[4] Max. zu Wied, Reise, I, p. 174.

[5] Catalogue of the Animals of Michigan, 1861.

[6] Amer. Nat., V, 1871, p. 314.

Kennicott considered the species not abundant in Illinois, but records it from Cook County.[1]

No specimens were reported to Dr. J. A. Allen from Iowa, but he regarded it as doubtless occurring in the eastern part of the State.[2]

Lapham stated in 1852 that there was a specimen from Milwaukee, Wisconsin, in the Museum of the Natural History Association at Madison,[3] and Strong states that its range includes the prairie region of the southern and central portions of the State.[4]

There is a specimen of the star-nosed mole (No. 964) from Hinckley, Minnesota, in the Museum of the Geological Survey of Minnesota,[5] according to the list of specimens published in the report of that survey.

We come now again to the outlying districts. Richardson includes the species among those which "may occur" in his Limestone Tract, but only in the southern portion. This portion of the tract is practically equivalent to Manitoba. He did not obtain any specimens from thence.[6]

Mr. Thompson writes regarding Manitoba: "Mr. Hines informs me that he has seen specimens of this mole taken within our province."[7] The exact points at which these specimens were seen is not mentioned.

So far as specimens are concerned, there is no evidence that the species is found anywhere in the United States west of the Mississippi (with one possible exception of Fort Ripley, Minnesota),[8] though, as we have seen, Dr. J. A. Allen considered its occurrence in eastern Iowa probable.

Prof. Erwin H. Barbour has written me regarding the occurrence of the species in Nebraska as follows:

> The star-nosed mole has been reported to me repeatedly. However, I have never seen one. Students have reported it so frequently that I think its occurrence in the State is reasonably sure.

I have encountered a few positive statements in the literature, which, if correct, render it necessary to extend the range of the star-nosed mole to the Pacific Coast, as Dobson has done. On theoretical grounds, I am strongly of the belief that these several records must be incorrect, though a demonstration in a matter of this kind is hardly to be made,

[1] Trans. Ill. State Agricultural Society.

[2] Proc. Boston Soc. Nat. Hist., XIII, 1870, p. 187.

[3] Trans. Wis. Agric. Soc. II, 1853, p. 338.

[4] Geology of Wisconsin, I, 1883, p. 438.

[5] Fourteenth Report Geol. Survey Minn., 1886, p. 142. See also Ames in Bull. Minn. Acad., 1874, p. 69.

[6] Fauna Bor. Amer., p. xxvii.

[7] Thompson, Mammals of Manitoba, p. 21.

[8] Fort Ripley, Minnesota, is on the east side of the river in some maps and on the west side in others. The land office map of 1892 indicates a town of this name on the east side and a fort on the west side. The single specimen in the collection probably came from the vicinity of the fort, and hence from the west side of the river.

as the fact that no specimens are now known does not preclude their being obtained hereafter.

It would seem improbable that anyone who had examined one of these moles could mistake its identity, considering the very peculiar character of the nasal appendage. If mistakes have occurred, it must have been through faulty field notes or lapses of memory.

One of the records referred to is that of Woodhouse. In the zoology of Sitgreave's Zuni and Colorado River Expedition, he remarks of the species: "This animal is very common in the Indian Territory."[1]

He does not support this positive statement by mention of any localities, and there were no specimens of the mole sent to the Smithsonian Institution with the mammals of the expedition. As no specimens have been taken within 500 miles of the Territory, the record would seem to need confirmation.

The records relating to the Pacific Coast are equally positive. Richardson, in an addendum to the report on the mammals of the Fauna Boreali Americana, introduces *Condylura macroura* Harlan (=*C. cristata*) with the following remark:

Since the greater part of the preceding sheets were printed off, Mr. David Douglas has presented me with a specimen of this remarkable animal, procured by him on the banks of the Columbia.[2]

There can be no doubt that this specimen was a *Condylura*, and if there is an error in this case it must be in the record of the locality. Douglas was on the Pacific Coast for three years, and had ample opportunities to obtain rarities, but he also crossed the continent going and returning, and may have picked up this specimen in southern Canada or in the vicinity of Hudson Bay. This is, however, entirely an assumption.

Another record occurs in Cooper and Suckley's Natural History of Washington Territory, as follows:

In 1852 I saw a very large star-nosed mole which had been killed at Orleans Bar on Klamath River.—G[ibbs].

Dr. Cooper saw at Vancouver, W. T., in 1853, a decayed specimen which had the appearance of having a radiated excrescence on the nose, but, being crushed and nearly destroyed, the specimen was unfit for preservation.[3]

In this second instance, Dr. Cooper may of course have been mistaken regarding the identity of his specimen, as it was in such bad condition, but Gibbs's statement is quite as positive as Richardson's. It is to be regretted that Gibbs did not specify where he saw the specimen he mentions.

The doubt which I throw on these Pacific Coast records is based (1) on the fact that if accepted it is necessary to suppose that an area of 1,200 or 1,400 miles in diameter in the middle of the range is uninhabited; (2) that no specimens from the Pacific Coast are to be found in

[1] Sitgreave's Zuni and Colorado R. Exp., p. 43.

[2] Fauna Bor. Amer., Mammalia, p. 284.

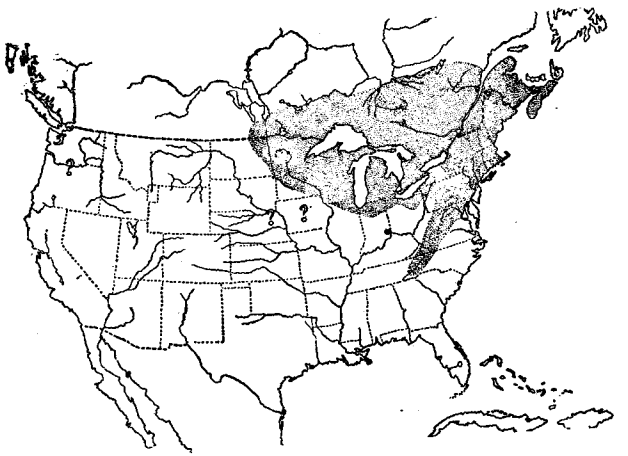
[3] Cooper and Suckley, Natural History of Wash. Ter., 1860, chapter 3 (by Suckley & Gibbs), p. 108.

any collection; (3) that no naturalists familiar with the region, with whom I have communicated, have ever seen or know of specimens taken there.

Mr. Walter E. Bryant wrote, under date of February 11, 1895: "I have never heard of the occurrence of *Condylura cristata* in California nor on the Pacific Coast."

VARIATION.

This species does not appear to present a large amount of variation, either geographical or individual. As the material at command is not extensive, however, it is possible that more variation exists than can now be shown.



GEOGRAPHICAL DISTRIBUTION OF CONDYLURA.

The coloration is, on the whole, remarkably uniform, and the size does not appear to vary in accordance with the geographical location of the specimens. One of the adult specimens from Locust Grove, New York, is much more reddish on the under surfaces than others from the same locality. This is especially true about the base of the tail. A skin from Erie, Pennsylvania, has much fewer coarse hairs on the belly than other specimens. These are quite widely separated and are light colored and shining, so that they give to the under surface a somewhat peculiar appearance. In many of the specimens a few of the longer hairs of the upper surface are white. In a young specimen from Fort Ripley, Minnesota (No. 567, N. M.), and an adult from Halifax, Nova Scotia (No. 3908, N. M.), the tip of the tail is white. This appears, however, to be merely an individual variation. In the former specimen also, that from Fort Ripley, the last lower premolar on the left side

has two equally high and prominent central cusps, instead of one. The tooth on the right side of the mandible is normal.

In several specimens the minute second upper incisor, or the third lower one, is absent on one or both sides, but unless the skull is in the best condition for study, it is extremely difficult to determine whether these teeth have merely fallen out, or whether they were absent from the first.

MOLTING.

The series of skins of the star-nosed mole obtained by Mr. Bangs at Belmont, Massachusetts, between October 6 and October 8, show that molting was then in progress. A male taken October 8 has the summer fur still in place all over the body, but new fur is concealed on all the upper surfaces. In another male taken at the same date the new fur has appeared on the head and rump and also on the throat, and is springing up all over the back, though still concealed. On the lower surfaces, except the throat, the summer fur still holds place. In still another specimen taken at the same date the condition of the new fur on the back is the same as in the last specimen, while on the lower surfaces the new fur has appeared everywhere except on the throat and legs. Two males taken October 6 and October 7, respectively, are about in the condition of the second specimen mentioned above.

The change is carried to its completion in Mr. Bangs's series from Digby, Nova Scotia. In specimens taken from October 10 to October 21 the upper surfaces are all covered by new fur, while the lower surfaces all have the summer fur, with the new concealed under it. In males taken October 27 and October 30 the change is complete and all summer fur has disappeared.

From these specimens we learn that the winter fur of this mole first appears on the surface about October 6, (in the North), completing its growth first on the head and rump, then on the back, and finally on the belly. Exactly when the new fur first begins to sprout is uncertain, but must be earlier than September 19, as a specimen taken at Cape Edward on that date has new fur concealed under the old. The rate of growth on the different parts of the body is not always the same.

As regards the change from winter to summer fur, it appears from Mr. Bangs's series that in Nova Scotia the males have completed it before July 18. The females, as in other species, retain the winter fur longer. One taken at Digby July 25 still has irregular patches of winter fur across the back. A female taken July 31 has the complete summer coat.

AGE CHARACTERS.

Young star-nosed moles are much redder than adults. The fur about the mouth and on the feet is also of a reddish-brown color, while in adults it is usually whitish. The tail is also slender in the young.

Besides the ordinary obliteration of sutures, a sign of maturity in

skulls of this species is the growth of median crests on the anterior portion of the sagittal suture, and on the posterior extremity of the nasals. This nasal crest is, so far as I am aware, unique among mammals.

The teeth are but little worn in any of the specimens which I have examined, which would seem to indicate that they have a thicker coat of enamel than those of *Scalops*, *Scapanus*, and *Parascalops*. In these the teeth show the effects of attrition at a comparatively early stage.[1]

THE TAIL AND NASAL DISK.

It is a well-known fact that the tail of the star-nosed mole is subject to a periodical enlargement. An individual in this condition was described by Harlan in 1825 as a distinct species, but Godman recognized the fact (in a publication of the same date[2]) that this character was not specific. He stated that all the specimens with enlarged tails which had been examined were males, and remarked: "It is most probable that the enlargement occurs only during the rutting season."

It now appears that Godman's opinion that the enlargement occurs only in males is not correct. Of ten completely labeled specimens with swollen tails which I have examined, five are males and five females. The swollen condition lasts at least from November to April, inclusive, and probably a month longer in spring. The tail is not enlarged in any of the specimens taken in the summer months.

It is probably correct to look upon this enlargement of the tail as a secondary sexual character, comparable to the growth of antlers in deer. It affects both sexes, however, which is the exception rather than the rule among deer. The enlargement occurs during the rutting season, as Dr. Merriam has remarked,[3] but the first litter is doubtless born while the tail of the adults is in the enlarged condition. Though the fact seems not to have been recorded, I judge from the examination of an immature individual that this first litter appears very early in spring. This being the case, there would still be time for the production of a second litter while the tails of adults were enlarged, but if more are produced, as Dr. Merriam states to be the fact, the later ones would be brought forth after the enlarged condition had disappeared. There are no observations, so far as I am aware, bearing directly on this point.

[1] A female from Williamstown, Massachusetts (No. 7469), contains 5 embryos about 12 mm. long, three on the right side of the uterus and two on the left. The fetus is rolled together in a compact form. The forefeet are pressed against the sides of the muzzle with the palms outward. The hind feet have the soles pressed together and the tail is curled over them. The cutaneous processes of the nose are reflexed over the muzzle.

[2] Journ. Phila. Acad., V, pt. 1, 1825, pp. 109–116.

[3] Trans. Linn. Soc. N. Y., II, p. 54.

The specimens at command have the tail as follows:

Cat. number.	Sex.	Date.	Condition of tail.	Preservation.
No. 4377, Merr.	.....	May 20	Slender	Alcoholic.
No. 2241, U. S. N. M.	.....	June or July.	....do	Do.
No. 11143, U. S. N. M.	.....	July —	....do	Skin.
No. 11245, U. S. N. M.	.....	July 1	....do	Alcoholic.
No. 669, Merr.	.....	July 2	....do	Do.
Unnumbered, U. S. N. M.	.....	July 24	....do	Do.
Unnumbered, Merr.	.....	Aug. 2	....do	Do.
No. 1637, Merr.	(Young) ..	Oct. 8	....do	Skin.
No. 515, Merr.	Male.....	Nov. 12	Swollen	Do.
No. 668, Merr.	.....	....do	....do	Alcoholic.
No. 516, Merr.	Female ...	Nov. 24	....do	Skin.
No. 517, Merr.	Female ...	Nov. 25	....do	Do.
No. 520, Merr.	Male.....	Nov. 26	....do	Do.
No. 518, Merr.	Male.....	....do	....do	Do.
No. 519, Merr.	Female ...	....do	....do	Do.
No. 1083, U. S. N. M.	Male.....	Dec. 15	....do	Do.
No. 52723, D. A.	Female ...	Mar. 3	Moderately swollen...	Do.
No. 52724, D. A.	Male.....	Mar. 31	Less swollen	Do.
No. 52725, D. A.	Female ...	Apr. 11	Moderately swollen...	Do.
No. 15225, U. S. N. M.	.....	May 15	Swollen	Alcoholic.

Although it is not the intention in this work to describe the anatomy of the various forms, in which direction much has been done by the late Dr. Dobson[1] and others, it seems desirable to include an account of the nasal disk of *Condylura* which was published about ten years ago by Mr. H. Ayres. As Mr. Ayres's description of the anatomy of this remarkable organ is brief, and is included in a publication not everywhere accessible, I have thought it desirable to quote it entire:

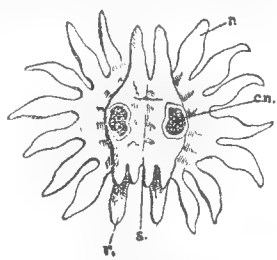
> The structure and development of the rays encircling the end of the snout in *Condylura* have not, so far as I am informed, been described. However, in the related genus *Talpa*, Eimer[2] has studied the structure of the snout of the common European mole, and considers it to be a highly developed tactile organ, on account of the characteristic nerve endings found in the numerous and rounded papillæ covering the surface of the end of the nose. This flexible snout is sharply marked off from the rest of the nose by the entire lack of hair and hair follicles.
>
> In *Condylura* the snout is much longer than in *Talpa*, and carries at its distal end a varying number of finger-shaped processes, which bound a cup-shaped or flat terminal disk (fig. 36), perforated on either side of its center by the oval nostrils (c. n.).
>
> Instead of a general distribution of the tactile papillæ over the surface of the snout itself, such as occurs in *Talpa*, one finds them confined, for the most part, to the flexible, finger-shaped processes (fig. 36). The papillæ, which are clearly visible to the unaided eye, appear, under a low magnifying power, as uniformly rounded prominences disposed in more or less regular rows, extending in the direction of the long axis of the ray.
>
> It is evident from the anatomical relationship of the two animals that *Condylura* is only a highly modified form of *Talpa*.[3] The lengthened tail, the elongated snout with its remarkable tactile organs, together with the extended skull and the increased number of teeth, are conditions indicating greater specialization; but still easily derivable from the more primitive talpine form. It is quite apparent that the increase in the extent of the tactile surface and its more definite localization in the case of *Condylura* are only expressions of the existence of a higher functional activity than is possessed by the homologous tract in *Talpa*.

[1] Monograph of the Insectivora.

[2] Arch. fiir mikr. Anatomie, VII, 1871, pp. 181–191, pl. 17.

[3] To this view of the affinity of the two genera I can not subscribe. F. W. T.

It would be interesting to know more of the habits of *Condylura* in order to learn in what respects they differ from those of *Talpa*, and by this means to ascertain the immediate causes of this remarkable sensorial adaptation. Since *Talpa* may be considered the more primitive form of the two, it becomes a matter of considerable interest to trace the development of these finger-shaped processes in *Condylura*. One would naturally expect that in their first stages of development they would simply resemble the rounded elevations of the papillated tactile surface of the snout of such a form as *Talpa europæa;* the parts of the snout most frequently brought in contact with foreign bodies ultimately developing the papillæ to a far greater extent than the remaining portions of the surface.

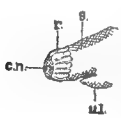


36.
NASAL DISK OF CONDYLURA.
(Enlarged.)

By a gradual elongation of such elevations, to be accounted for on the principle of adaptation to environment, they would acquire the finger-like form present in *Condylura*. Their arrangement on the edge of a subreniform disk receives its explanation in the fact that the nerve endings are in this manner placed in a position most advantageous for the exercise of their special function.

When we trace the development of the snout in *Condylura*, we find that the assumed method of growth is very nearly an expression of what actually takes place. In the course of the development there arises an interesting complication of the simpler process, the evident meaning of which is the shortening, in point of time, of the growth of the papillæ—i. e., it is an economic adaptation. This modification I shall now describe.

At birth the star-nosed mole is nearly destitute of visible hair, and the tactile bristles of the facial region have not made their appearance at the surface. The snout of the young *Condylura* lacks all the distinctive characteristics of the adult, and the entire body resembles that of *Talpa* much more than it does its parent. On a close examination of the distal end of the snout of such a new-born animal (fig. 37), one can distinguish a tract of skin which covers four-fifths of the circumference of the organ (the part not specially marked off is the median ventral fifth). This dermal tract extends for 3 mm. toward the base of the snout and is marked off from the remaining surface by a series of furrows running parallel to the long axis of the body. A series of parallel ridges is thus formed, each ridge being bounded on either side by a furrow. At their anterior and posterior ends these ridges pass gradually into the neighboring smooth surface. By a gradual ingrowth of the bottoms of the furrows each groove is deepened and each ridge suffers a correspondingly increased definition of form, while at the same time the posterior end of each groove grows toward its neighbor on either side. When the grooves have all united, there is formed by their union a common groove which nearly encircles the snout and separates the tactile from the remaining surface of that organ.



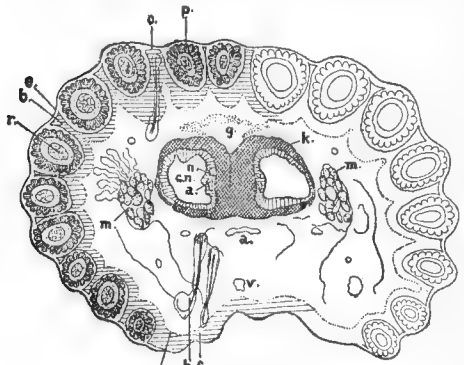
37.
SNOUT OF YOUNG CONDYLURA.

Commencing at the posterior margin of the tactile surface and advancing toward the tip of the snout, the grooves deepen and grow toward each other in their bottom portions until they finally coalesce underneath the ridges. The result of this process is the production of free, finger-shaped processes composed exclusively of ectoderm, attached to the anterior end of the snout in the manner already described for the adult.

These processes of the ectoderm become the tactile rays of the adult. The nasal area from which the tentacular processes are formed is not thereby denuded of

skin, but remains covered by that portion of the primary surface which formed the bottoms of the grooves and which has so increased in extent that at this stage the surface is entirely and uniformly covered by ectoderm. No traces are left either on the surface or in the corium of the extensive excision which has taken place.

The principal details of the process are readily seen on examining a section of the snout, such as is represented in fig. 38. In this figure I have drawn, with the aid of camera outlines and with diagrammatic shading, a transverse section of that part of the nose of a young *Condylura* indicated by the line *r*, fig. 37. The following is a short account of the most important histological details of the process. The entire circumference of the section is bounded by a thin layer of epidermal cells *e*, beneath which all the formative processes take place. In the stage of development represented in fig. 38, this layer only loosely covers the snout in the region of the papillæ and later is entirely cast off; but it remains in intimate connection with the remaining surface and functions as the true epidermal layer, as at *f*. The letters *o p* designate respectively the epidermis of the tentaculiferous area and that of the sense rays. The rays are embedded in a layer of fibrous tissue, which, however, does not entirely cover the outer surface of the ray.



38.

TRANSVERSE SECTION OF SNOUT OF YOUNG CONDYLURA.

(Enlarged.)

a = arteries; *b* = ridge-like remnants of the primitive ectoderm seen in section; *b* = boundary line between Rete Malpighii and corium; *cn* = nostrils; *e* = cornified layer of the epidermis; *g* = cartilaginous tissue; *h* = hair follicle and accessory gland; *k* = nasal cartilage; *m* = nasal muscles; *n* = nerve supplying the mucous membrane of the nose; *o* = the future outer surface of the snout; *p* = papillæ; *r* = tactile ray, the line points to the central connective tissue core, through which the blood vessels and nerves pass; *v* = vein.

Sections of the ray present a crenate margin owing to their passage through the numerous tactile papillæ which cover the surface of the ray; there are three sharply marked concentric layers of tissue to be observed in each: An outer, cornified layer of the epidermis, the deeper Malpighian layer, and a central rod of connective tissue within which the nerves and blood vessels are embedded.

There are no traces of hair follicles, sebaceous or sweat glands to be seen on the tentacles, but they occur in the proximal half of the tentaculiferous area, and only make their appearance on the surface of the snout after the tentacles have assumed their erect condition. At *i* and *h* are seen the hair follicles with the young hairs. The corium is an extensive layer filling all the space between the epidermis and the nasal cartilage. The small muscles of this part of the face appear to be entirely embedded within this layer.[1]

[1] On the Structure and Development of the Nasal Rays in *Condylura cristata*. By H. Ayres. Biolog. Centralblatt, IV, 1885, pp. 356–360.

HISTORY.

We encounter this species for the first time under the name of *Sorex cristatus* in the tenth edition of Linnæus's Systema Naturæ (1758, p. 53). He gives Pennsylvania as its habitat, on the authority of Kalm. The description is recognizable, though in some respects faulty, as, for example, in relation to the number of processes of the nasal crest and the length of the tail. Houttuyn, in 1761,[1] merely paraphrases Linnæus's description and adds nothing. The description of the twelfth edition of the Systema Naturæ[2] is essentially the same as that of the tenth edition. The next author who mentions the star-nosed mole appears to have been Pennant, who published the first edition of his Synopsis of Quadrupeds in 1771. I have not had access to this work, which contained both a description and a figure.[3] I suppose that the figure was the same as that which appears in the third edition of his work, published in 1783. This latter figure, though crude, is recognizable, but the tail is too short, an error which seems to have been perpetuated for a long time.

Pennant appears to have originated in his first edition the erroneous statement that the star-nosed mole subsists upon roots. He had, however, the merit of placing the species among the moles rather than with the shrews.

In the first edition he included also a description and figure[4] of a "long-tailed mole." If this description is the same as that of the third edition, the phrase "mole with a radiated nose" must have been overlooked by Erxleben, who records the species in 1777 under the name of *Talpa longicaudata*, and seems to have had no suspicion that it was related to the star-nosed mole.[5] He records also the latter, uniting the descriptions of the authors who preceded him, including both errors and facts. He retains the species in the genus *Sorex*, but states that "*Sorex cristatus* and *aquaticus* agree with the mole in the form of the body and its habit, but, so far as the teeth are concerned, have the structure of the shrews."[6]

Schreber, in 1778, copies Linnæus and Pennant.[7]

Pennant's figure of the star-nosed mole, in the third edition of his Quadrupeds, 1783, has already been referred to. It was apparently made from a specimen in the Leverian Museum.[8] His figure of the

[1] Nat. Hist. of Dieren, 1 deel, 2 stuk, 1761, p. 315.

[2] Linn. Syst. Nat., 12th ed., 1766, p. 73.

[3] Cf. Linn. Syst. Nat., 13th ed., 1788, p. 112.

[4] P. 314, No. 244, pl. 28, fig. 2. (Fide Gmelin.)

[5] Syst. Regn. Animal., 1777, p. 118. Müller in 1773 (Des Linné Natursystem, I, 1773, p. 300) mentions *C. cristata* under the name of "Die Haarnase, *Sorex cristata*," but gives no new information regarding it. He does not mention the "long-tailed mole."

[6] Loc. cit., p. 121, footnote.

[7] Saügethiere, 3 Th., 1778 (?), p. 561.—"Der langschwanzte Maulwurf. P. 566, "Der Kammnase."

[8] History of Quadrupeds, 3d ed., II, 1783, p. 232, pl. 90, fig. 1, No. 442.

"long-tailed mole" also appears in this edition.[1] It shows little more than a trace of the nasal crest, and were it not for the phrase "mole with a radiated nose" in the description, one might suppose that it had no relation to *C. cristata*, as Erxleben seems to have done. It is to be remarked regarding both these figures that the tail is abnormally short. One can only suppose that they were based on young specimens, overstretched as regards the body, or that the tail was drawn in in skinning, and not afterwards restored to its proper position.

Gmelin, in the thirteenth edition of Linnæus's Systema Naturæ, recognizes both "*Sorex cristatus*" and "*Talpa longicaudata*."[2] His descriptions do not differ materially from those of Erxleben.

Kerr, writing in 1792,[3] seems to have entertained the idea that the two species were related, as he places *longicaudata* immediately after *cristata* in the genus *Talpa*. He adds nothing, however, to Pennant's account.

Shaw retains the two nominal species among the moles in his General Zoology,[4] but remarks under the "Radiated Mole:" "It is, perhaps, in reality no other than a variety of the former species, or a sexual difference."

The star-nosed mole was placed in its present genus, *Condylura*, by Illiger, in 1811.[5] As species he has "*Sorex cristata* Linn., *Talpa longicaudata* Linn. Gmel."

Cuvier recognizes only the species *cristatus* in the Regne Animal, but places it under the genus *Talpa*, and remarks that it is a true mole and that the characters on which Illiger based the genus *Condylura* are false.[6]

This course was not acceptable to Desmarest, who revived the genus *Condylura* and recognized the same species as Illiger, *C. cristata* and *longicaudata*.[7] Dr. Harlan, in 1825, accepted this arrangement and added a third species, *C. macroura*, from a specimen in the Philadelphia Museum (No. 836), which had the tail in the swollen state. Dr. Harris described another specimen in this condition the same year, under the name of *Condylura prasinata*.

Godman was of the opinion that this swelling of the tail was not a specific character, and in his Natural History, of which the first edition appeared in 1826, recognized only *C. cristata*.

All four species were enumerated by Wagner again in 1841, in Schreber's Saügethiere, but in an appendix he calls attention to Godman's view.

In the great work of Audubon and Bachman only the single Linnæan

[1] History of Quadrupeds, 3d ed., II, 1783, p. 232, pl. 90, fig. 2.
[2] I, 1788, pp. 118 and 121.
[3] The Animal Kingdom of Linnæus, 1792, p. 202.
[4] I, pt. 2, 1800, p. 523.
[5] Prodromus systematis mammalium et avium, 1811, p. 125.
[6] Regnè Animal, 1st ed., I, 1817, p. 138.
[7] Mammalogie, I, 1820, pp. 157–158.

species is recognized, and there has been practically no difference of opinion on the subject of species since the publication of that treatise, though all the names appear in the uncritical compilation of Fitzinger in 1869.

The generic name *Condylura* was replaced by *Rhinaster* by Wagler in 1830, because he considered the former appellation misleading. "Wie bekannt," he remarks, "ist der Schwanz dieses Thieres vollkommen eben."[1] Gray employed the name *Astromycles* for the genus, in 1843, in his List of Mammals in the British Museum, but credits it to Harris, who did not use it. A new name—*Astromydes*—was coined by Blyth in 1863.

MEASUREMENTS.

Collector's measurements of six specimens, both males and females, from Locust Grove, New York, in Dr. Merriam's collection, give an average of 202 mm. for the total length (including the tail), with a maximum of 212 mm. and minimum of 200 mm.

This average, it will be observed, is higher than that given by the alcoholic specimens.

Dimensions of alcoholic specimens of Condylura cristata.

Measurements.	Males.				Females.			
	Average.	Maximum.	Minimum.	No. of specimens.	Average.	Maximum.	Minimum.	No. of specimens.
	mm.	*mm.*	*mm.*		*mm.*	*mm.*	*mm.*	
Length of head and body	97.4	101.5	92.4	10	99.3	110.5	88.2	11
Length of tail vertebræ	69.6	80.3	55.7	10	73.9	82.0	59.8	11
Length of tail with hairs	73.9	85.9	61.6	10	80.5	91.0	67.4	11
Length from nose to eye	15.8	17.8	14.2	9	15.3	16.3	13.8	9
Length of fore foot and claw	20.4	21.5	19.0	10	20.8	23.0	19.0	11
Greatest breadth of fore foot	10.6	11.5	9.4	10	11.1	12.4	9.6	11
Length of hind foot and claw	26.7	29.3	24.9	10	27.4	29.4	25.2	11
Length of longest hair of back	10.7	.....	.....	.....	10.9	.....	.....	.....

Average, maximum, and minimum dimensions of adult skulls of Condylura cristata.[2]

	Average.	Maximum.	Minimum	Number of skulls.
	mm.	*mm.*	*mm.*	
Greatest length (exclusive of incisors)	34.0	34.8	32.5	7
Basilar length (Hensel)	27.7	28.4	26.6	7
Greatest breadth	13.7	14.3	13.0	7
Length of foramen magnum	6.6	7.0	6.4	7
Breadth of foramen magnum (at middle of its length)	3.4	3.8	3.2	7
Palate length	13.7	14.2	13.0	7
Length of upper tooth row (base of crowns)	15.2	15.7	14.0	7
Least interorbital breadth (back of frontals)	7.1	7.4	6.4	7
Length of mandible, from inner base of incisors to end of angular process	22.0	22.4	21.0	7
End of angular process to end of coronoid	8.5	9.0	8.0	7

[1] Natur. Syst. Amphib., 1830, p. 14.

[2] As there appears to be no difference in proportions between male and female skulls, both are included in the averages.

Dimensions of thirty-one skulls of Condylura cristata from various localities.

Catalogue number.		Collection.	Locality.	Sex.	Total length.	Basilar length (Hensel).	Length of palate from inside first incisor.	Mastoid breadth.	Greatest zygomatic breadth.	Length of upper tooth row.	Breadth between postero-internal angles of first upper molars.	Angle of mandible to condyle.	Age.
Skull.	Skin.												
					mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
3908	.....	Bangs	Lake Edward, Quebec.	♀	34.0	26.9	13.5	13.3	.....	15.0	7.5	6.6	Adult.
1210	.....	.....do	Digby, Nova Scotia.	♂	35.0	28.5	14.5	13.7	10.6	15.8	7.7	7.0	Do.
1211	.....	.....do	.....do	♂	34.8	27.4	14.3	13.7	.....	15.2	8.2	6.7	Do.
1212	.....	.....do	.....do	♂	34.0	27.3	14.0	13.2	10.2	15.2	7.8	6.4	Do.
1214	.....	.....do	.....do	♂	35.4	28.5	13.4	13.5	10.1	15.0	7.3	6.2	Do.
1215	.....	.....do	.....do	♂	34.4	27.2	14.0	13.3	.....	15.0	7.6	6.5	Do.
2093	.....	.....do	.....do	♂	35.2	27.8	14.2	14.0	.....	15.5	8.0	6.8	Do.
2096	.....	.....do	.....do	♂	35.0	27.8	14.5	13.5	10.2	15.5	7.8	6.8	Do.
2097	.....	.....do	.....do	♂	35.0	28.2	14.2	13.4	10.5	15.6	7.9	6.9	Do.
2099	.....	.....do	.....do	♂	33.5	27.0	13.6	13.5	.....	15.0	7.0	6.5	Do.
2100	.....	.....do	.....do	♂	34.0	27.0	13.6	13.2	10.2	15.0	7.5	6.5	Do.
2095	.....	.....do	.....do	♀	35.0	27.2	14.0	14.0	10.0	15.0	8.0	6.5	Do.
2101	.....	.....do	.....do	♀	34.2	27.0	14.0	13.4	.....	15.0	8.0	6.5	Do.
1213	.....	.....do	.....do	♀	33.8	26.6	13.2	13.0	.....	14.9	7.5	6.7	Do.
4336	.....	.....do	Belmont, Mass ..	♂	35.2	28.2	14.0	13.5	.....	15.2	8.0	7.0	Do.
4337	.....	.....do	.....do	♂	35.0	28.0	14.0	13.0	.....	15.0	7.6	6.8	Do.
4338	.....	.....do	.....do	♂	35.5	27.8	13.5	13.8	10.2	15.0	8.0	7.0	Do.
4339	.....	.....do	.....do	♂	36.0	29.0	14.4	13.6	10.0	16.0	7.5	7.0	Do.
3115	2243	Nat. Mus ...	Middleboro, Mass.	...	35.4	27.5	13.5	14.4	.....	15.2	8.0	6.6	Do.
64346	.....	Dept. Agric.	East Hartford, Conn.	♂	33.6	.....	.....	13.2	.....	.....	.....	.....	Do.
1690	568	Nat. Mus ...	St. Lawrence County, N. Y.	...	.....	.....	.....	.....	.....	15.0	.....	.....	Adult or less.
1012	.....	Merriam	Locust Grove, N. Y.	♀	36.0	28.3	13.8	13.7	10.4	16.1	7.8	6.9	Adult.
1010	.....	.....do	.....do	♂	36.0	28.3	13.8	13.9	10.0	15.3	7.6	6.5	Do.
1011	.....	.....do	.....do	♂	35.3	28.4	13.7	14.0	10.4	15.7	7.8	7.1	Do.
5162	.....	.....do	(?) ..do	...	35.0	27.6	13.6	13.2	10.2	15.0	7.3	6.8	Do.
1008	.....	.....do	.....do	♂	34.9	27.6	13.4	13.8	10.5	16.0	7.4	6.8	Do.
1009	.....	.....do	.....do	♀	33.6	26.8	13.2	13.9	10.4	15.1	7.8	6.7	Do.
4857	.....	Nat. Mus ...	Chester County, Pa.	...	34.4	27.3	13.6	13.2	.....	15.0	7.2	6.2	Do.
582	.....	.....do	Carlisle, Pa.....	...	33.6	.....	13.7	13.2	.....	.....	.....	.....	Do.
52723	.....	Dept. Agric.	Garrettsville, Ohio.	♀	31.7	.....	13.2	13.3	.....	.....	.....	.....	Do.
52724	.....	.....do	.....do	♂	32.7	.....	13.2	13.4	.....	.....	.....	.....	Do.

NEÜROTRICHUS, Günther.

Neürotrichus, GÜNTHER, Proc. Zool. Soc. London, 1880, p. 441.

Body talpiform. Tail elongate. Snout long. Nostrils in the sides of the terminal naked pad of the snout. Eyes minute. Fore feet broad, but without *os falciforme*; furnished with long, rather sharp, and somewhat compressed claws.

Dental formula i, $\frac{3}{3}$; c, $\frac{1}{1}$; pm, $\frac{2}{2}$; m, $\frac{3}{3}$; total, 36.

Anterior upper incisors broad. Internal basal cusp of second upper molar bilobed. Tympanic bullæ incomplete.

This genus is very closely allied to the *Urotrichus* of Japan, and a diagnosis framed to contrast it with that form could contain only characters based on the dentition. All the other characters given above are common to the two genera.[1]

[1]The differences in the number and size of the scales and tubercles of the feet, represented in Dr. Günther's figures, are illusive. These parts are practically identical in both forms.

The differences in dentition are much more than mere absence of one tooth above in *Neürotrichus* and one below in *Urotrichus*. The Japanese mole has the first upper incisor long, slender, and curved, with an external accessory cusp, while in *Neürotrichus* this tooth is broad and flat. The second tooth in *Urotrichus* is like the first, but only about half the size, while the third and fourth are minute and simple. In *Neürotrichus* the second and third teeth are about equal in size (much smaller than the first) and compressed, while the fourth is much larger, thick and conical. Leaving out of consideration the fifth tooth in *Urotrichus*, the sixth is single-rooted, while in *Neürotrichus* the corresponding tooth (fifth) is double-rooted.

In the mandibular teeth the differences are fully as striking. The first four teeth in *Neürotrichus* have rounded oblique crowns, and are graduated in size from in front backward. In *Urotrichus* the first and second teeth are somewhat like the upper ones, long and crooked, the second much smaller than the first, with a linear and very oblique crown; then follows a tooth of medium size with oblique, somewhat spatulate crown, and another very small one.

The milk dentition of *Neürotrichus* in some particulars resembles that of the Japanese mole more than the permanent dentition, but I have not been able to examine a specimen of the American mole with complete milk dentition.

The Japanese mole is much larger than *Neürotrichus*.

NEÜROTRICHUS GIBBSII (Baird).

GIBBS' MOLE.

Urotrichus gibbsii, BAIRD, Rept. Pacific R. R. Survey, VIII, 1857, p. 76, pl. XXVIII; Mammals of North America, 1859, p. 76, pl. XXVIII.

Neürotrichus gibbsii, GÜNTHER, Proc. Zool. Soc. London, 1880, p. 441, pl. XLII.

Diagnosis.—Tail two-thirds the length of the head and body, scaly and sparsely clothed with long black hairs. Feet scaly and sparsely clothed like the tail. Fore foot two-thirds as long as hind foot,[1] and a little more than half as broad as long. Fore claws longer than the toes. Eye minute. Auricular orifice large.

Color uniform deep dusky brown, with hoary reflections and purple iridescence.

Upper canine two-rooted. Second and third upper incisors small, subequal. Crowns of lower incisors and canine oblique. Mandibular angle slender and curved.

Average dimensions of 33 specimens from Sumas, British Columbia.—Total length, 113.6 mm.; tail, 37.1 mm.; hind foot, 16.6 mm.

Average dimensions of 12 skulls from Sumas, British Columbia.—Total length, 22.8 mm.; basilar length (Hensel), 18.3 mm.; mastoid breadth,

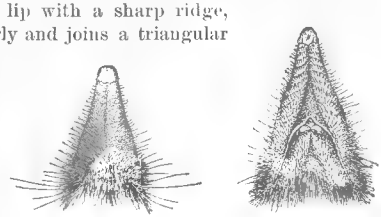
[1] Exclusive of the claw in both cases.

10.4 mm.; breadth between postero-external angles of first molars, 6.1 mm.

Distribution.—Pacific Coast of North America west of the Cascade and Sierra Nevada Mountains, from Fraser River, British Columbia, to Shasta County, California, and thence southward along the coast to San Francisco Bay.

DESCRIPTION.[1]

Body depressed. Head conical, with an elongated snout, which is rugose, naked above as far back as the line of the incisors, and terminates in a pad or button. Nostrils comma-shaped, lateral, in the sides of the lateral pad. Upper lip with a sharp ridge, which is emarginate anteriorly and joins a triangular naked median area which runs forward to the end of the snout, as in *Parascalops* and *Scalops*.

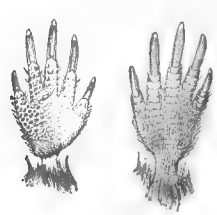


39. 40.

SNOUT OF NEÜROTRICHUS GIBBSII.
Fig. 39, Upper surface. Fig. 40, Lower surface.
(Twice natural size.)

Eye moderately large for this family, concealed in the fur, but not covered by membrane; situated above and somewhat behind the corner of the mouth. No external ear. Auricular orifice large, of varying contour, according as the surrounding integuments are tense or lax.

Fore feet broad, scaly above and warty below; palm longer than broad. Back of the toes each with three or four large scales. Toes not webbed. Second, third, and fourth toes subequal and largest, with broad acute nearly straight claws which are half as long as the palm. First and fifth toes shorter and with shorter claws. Fifth claw reaching to the base of the fourth; the first to the middle of the second.



41. 42.

FORE FOOT OF NEÜROTRICHUS GIBBSII.
Fig. 41, Lower surface. Fig. 42, Upper surface.
(Twice natural size.)

Hind feet nearly twice as long as the fore feet, narrow; covered above with rounded scales and sparse hairs; below scaly, naked, with six tubercles, of which one is at the base of the conjoined third and fourth toes, one at the base of the second and third toes, two others at bases of first, second, and fifth toes, respectively, and two more near the middle of the sole. Second and fourth toes subequal and longest; first and fifth shorter.

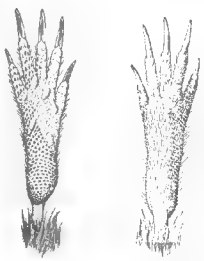
Claws of the second, third, and fourth toes as long as the toes themselves, compressed, acute, gently curved and twisted inward at the

[1] No. 10717, U.S.N.M. Simiahmoo, Wash. Male, young. Alcoholic.

extremities. Claws of the first and fifth toes much shorter. First toe placed farther back than the others, so that its claw does not reach to the base of the second toe. Claw of fifth toe reaches to the base of the fourth toe.

Tail a little more than twice as long as the hind foot (with the claw); terete, constricted at the base, covered with about 63 rows of scales and with long hairs which do not conceal the scales.

Fur all of one kind, consisting of long hairs of different diameters, which are dull and irregularly crenulate below, with long shining tips. Color dusky brown throughout, with hoary and purple reflections. The hairs of the feet and tail are dusky like the fur of the body. Young apparently paler and browner.



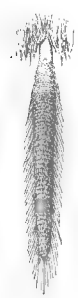
43. 44.

HIND FOOT OF NEÖTRICHUS GIBBSII.

Fig. 43, Lower surface. Fig. 44, Upper surface. (Twice natural size.)

SKULL.

Skull conical and depressed, smooth and without prominent crests or ridges. Rostrum moderately elongated, flattened superiorly. Nasals emarginate in front and much shorter than the intermaxillæ. Zygomatic arches short, slender, slightly convex upward and inserted high up posteriorly. Infraorbital foramen large, having the minute lachrymal foramen above its anterior margin.



45.

TAIL OF NEÖTRICHUS GIBBSII. (Natural size.)

Nasals short and broad, with moderate sinuses. Parietals irregularly pentagonal, the longest side in the median line. Occipital large and broad with two large lobes which reach forward to join the emarginate posterior border of the parietals. Squamosals low, and very irregular in form, with a broad quadrate portion above the tympanic bullæ. Foramen magnum large, oval. Tympanic bullæ, annular, broadest antero-internally. Palate concave with an emarginate posterior border opposite the last molar. Horizontal ramus of mandible nearly straight, slender. Coronoid process large, high, and strongly hooked. Angle similar in form, but smaller.

TEETH.

I, $\frac{3}{3}$; c, $\frac{1}{1}$; pm, $\frac{2}{2}$; m, $\frac{3}{3}$; total, 36. First upper incisors orbicular, much larger than the second and third. The latter subequal and smaller than the canine, which is two rooted and triangular, with a slight posterior accessory cusp. First premolar one-third smaller than and of like form with the canine; much smaller than the second premolar. The latter is a large triangular tooth with a prominent internal basal tubercle or heel. Molars of normal form; the internal basal cusp of the first and second bilobed.

All the mandibular teeth to the last premolar with oblique crowns. Crowns of the three incisors broad, decreasing in size from the first to the third. Canine similar to the third incisor, but smaller, and with a posterior basal tubercle. First premolar large and thicker and less oblique. Second premolar very much larger and more massive; nearly conical, but with a posterior basal prolongation. Molars W-shaped in transverse section, longer than broad; the first and second subequal and the third one-third smaller.

GEOGRAPHICAL DISTRIBUTION.

I have examined in all 51 specimens of this mole. These specimens are from widely remote localities, and I am disposed to think that they indicate fairly well the present range of the species, except that there is likely to be a further southward extension in the Sierra Nevadas.

The type of the species was from the White River Pass, north of Mount Rainier, Washington, and there is another specimen in the National Museum from Simiahmoo in the same State, and 34 specimens from Sumas, British Columbia, on the south side of the Fraser River (long. 122° W.).

In the Department of Agriculture collection are eight specimens from Washington, two from Steilacoom, four from Lake Cushman, in the northwest part of Mason County, on the Skokomish River; one from Tenino, and one from Seattle. The National Museum has one specimen from Elkhead, Douglas County, Oregon, and the Department of Agriculture one from Siskiyou in that State. The remainder of the specimens are from northern California; one from Crescent City (D. A.); three from Carberry's Ranch (D. A.), which is on the summit of the Sierra Nevada Mountains, about 50 miles east of Redding; two from Nicasio, Marin County (1 D. A., 1 A. M.).

Lord met with the species in British Columbia on the Sumas (or Chilliwack) prairies on the west side of the Cascade Mountains, near the Fraser River, probably on the identical spot from which the large series in the National Museum was obtained.[1]

Dobson includes Texas in the range of the species,[2] but on what grounds I do not know.

From present evidence it would appear that the range of *Neürotrichus* covers an area on the Pacific Coast of North America west of the Cascade and Sierra Nevada Mountains, extending from the Fraser River in British Columbia, immediately north of the boundary of the United States, to San Francisco Bay. At two points, namely, at the

[1] Proc. Zool. Soc. London, 1864, 161. "The first and only place in which I ever met this strange little fellow was on the [Chilliwack] prairies. These large grassy openings or prairies are situated near the Fraser River, on the western side of the Cascade Mountains." (LORD, Naturalist in British Columbia, I, 1866, p. 341, with a plate.)

[2] Monogr. Insectivora, 1883, p. 143.

White River Pass, Washington, and at Carberry's Ranch, California, the range is known to extend into the mountains, and the species may yet be found on the east side and also farther south in the Sierra Nevadas. No specimens have been found in the Sacramento Valley, however, and it will perhaps be found that south of Carberry's Ranch, at the junction of the Sierra Nevada and coast ranges, the eastern boundary follows the line of the latter rather than the former.

GEOGRAPHICAL DISTRIBUTION OF NEÜROTRICHUS.

GEOGRAPHICAL VARIATION.

The specimens at hand are not sufficient for demonstrating the extent of the variation in *Neürotrichus*. The indications, however, are that there is only a slight variation in size, and certainly no important variation in color. The only considerable series of specimens from one locality is that from Sumas, British Columbia. This includes 12 males and 21 females, which are adult or nearly so. The average and maximum dimensions of these according to the collector's measurements are as follows:

Measurements.	Average.	Maximum.
MALES.		
	mm.	*mm.*
Total length	111.5	116.0
Tail	37.1	40.0
Hind foot	16.5	17.5
FEMALES.		
Total length	114.4	123.0
Tail	37.1	41.5
Hind foot	16.6	17.5

It will be seen that the average total length of the females is a little greater than that of the males, which is probably due to the presence of more well developed individuals among the former than the latter in the series, and not to any real difference in size between the sexes, seeing that the average length of tail and hind foot is practically identical in both sexes. At all events the averages for the combined series of 33 specimens are as follows: Total length, 113.6 mm.; tail, 37.1 mm.; hind foot, 16.6 mm. The maximums are as follows: Total length, 123 mm.; tail, 41.5 mm.; hind foot, 17.5 mm. I have measurements of only one fresh specimen from farther south to compare with these. It is from Marin County, California (No. 2585, A. M.): Total length, 117.5 mm.; tail, 38.1 mm. It will be seen that this exceeds the average of the Sumas series, but falls short of the maximum. So far as it goes, therefore, it does not indicate any increase in size southward.

The skull of this California specimen exceeds that of the Sumas specimen, which has the maximum external proportions by eight-tenths of a millimeter, and is the largest skull examined. There is only one other complete adult California skull (No. 24010, D. A., Crescent City, California), and this equals the largest of the Sumas series, and exceeds the average of the same by four-tenths of a millimeter.

Measurements of six dry skins from Washington and three from California, all by the same collector, give the following results:

Measurements.	Average, 6 specimens, Washington.	Average, 3 specimens, California.
	mm.	*mm.*
Total length	114.0	125.6
Length of tail	39.9	45.5
Length of hind foot (without claw)	13.0	14.1

These dimensions are probably nearly correct, and would appear to indicate a more considerable increase southward than is shown by the other data, but as in the case of all dry skins, results from measurements are likely to prove unreliable.

It is probably safe to assume that there is a slight increase in size toward the South in this species.

DATES OF MOLT.

The specimens of *Neürotrichus* examined give some indication of the periods of changing the fur, but are not sufficient to determine the dates with exactitude. A male from Steilacoom, Washington, taken October 12, has new fur concealed on the posterior half of the back and old fur elsewhere. Another individual from the same place (and supposed to be a female), taken October 9, has the change much further advanced, the new fur covering all the back. The under surfaces still retain the old fur. All that can be learned from these two specimens is that the fall molt takes place in October. Why the female is so much further advanced than the male is not explainable.

An old individual (probably a male) from Sumas, British Columbia, taken April 19, has the new fur concealed under the old over the whole body. Another old male from the same locality, taken April 20, has an isolated area of short fur on the back of the neck, but I am in doubt as to whether this is a genuine evidence of molting. The series from Sumas comprises thirty-four specimens with dates from April 12 to June 21, but I have been unable to find any evidences of molting other than those mentioned. From this I can only suppose that the change, except in very old individuals, does not begin earlier than the last week in June at the northern limit of the range of the species.

A larger number of specimens were taken in spring and several of these are molting. One is from Lake Cushman, Washington (a male), taken June 23, and has entire new fur, except a small area above the base of the tail and another on the right flank. Two other males taken at the same place, June 21 and June 27, respectively, appear to have completed or practically completed the molt. From these specimens it would appear that the spring molt in this northern locality is not ordinarily completed until the latter part of June. It is earlier further south.

A specimen (male) from Carberry's Ranch, California, on the Sierra Nevadas, taken May 23, has nearly completed the molt, having the old fur only on the posterior half of the back. Two others from the same locality (one known to be a male) taken May 22 and 18, respectively, appear to have completely changed. From this material it is probable that the molt is complete at this point in all ordinary cases prior to the 1st of June.

In Oregon, as might be expected, the change seems to take place at a period intermediate between those of the Washington and California specimens. A male taken June 8 at Siskiyou, Oregon, appears to have new fur entirely.

DESCRIPTION OF THE TYPE SPECIMEN OF NEOTRICHUS GIBBSII (BAIRD).

The type of the species is No. $\frac{6\,6\,2}{1\,8\,5\,4}$, U.S.N.M. It was collected by Dr. Suckley in July, 1854, in the White River Pass, north of Mount Rainier, Washington. It is a young individual, as is shown by its size, and by the fact that some of the milk teeth are still retained. The skin appears to be somewhat faded, but is otherwise in good condition, but the skull is badly broken and incomplete.

The head and body measured on the skin are 56.5 mm.; the tail vertebræ, 33 mm., and the hind foot (without the claw), 12.4 mm.

The skull, as already stated, retains the majority of the milk teeth. The milk incisors and canine are small unicuspidate single-rooted teeth. The second upper milk premolar is a large two-rooted tooth, of the same triangular form as its permanent successor. The first premolar is smaller, but still as large as the permanent one, and like it also two-rooted.

The lower milk incisors are absent. The canine is small and unicuspidate. The first premolar is two-rooted and about as large as the permanent one and probably of similar shape, but it is considerably worn down so that its original form can not be made out. The same is true of the second milk premolar, which is two-rooted and as large as its successor.[1]

46.

JAWS OF TYPE OF NEÜROTRICHUS GIBBSII.

(2½ times natural size.)

HISTORY OF THE SPECIES.

The history of Gibbs's mole is very simple. The species was first described by Professor Baird, in 1857,[2] from a young specimen obtained by Dr. Suckley in the White River Pass, Washington. It was placed in the Japanese genus *Urotrichus*, to which it bears a very close external resemblance. In 1880 Dr. Günther called attention to the differences in dentition, and established the genus *Neürotrichus* for the American form.[3] Since that date no changes have been made in the status of the form, but probably from lack of specimens in European museums the validity of Dr. Günther's genus has not been so generally recognized as it deserves to be.

Dimensions of skulls of Neürotrichus gibbsii.

Catalogue number. Skull.	Skin.	Collection.	Locality.	Sex.	Total length.	Basilar length (Hensel).	Length of palate from inside first incisor.	Mastoid breadth.	Greatest zygomatic breadth.	Breadth between postero-external angles of first molars.	Height of coronoid process.	Age.
					Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	
62952	....	Nat. Mus ...	Sumas, B. C.....	♂	24.0	18.3	10.0	10.3	8.4	6.2	3.0	Adult.
62126	....	....do	....do	♂	22.3	18.2	9.7	10.5	8.3	6.0	2.6	Do.
62432	....	....do	....do	♂	22.5	18.2	10.0	10.1	8.0	5.7	2.7	Do.
62429	....	....do	....do	♂	22.7	18.2	10.0	10.5	.....	6.0	2.6	Do.
62436	....	....do	....do	♂	22.5	18.2	10.0	10.2	8.1	6.0	2.8	Do.
62965	....	....do	....do	♂	24.2	18.4	10.0	10.4	8.2	5.8	2.7	Do.
62963	....	....do	....do	♀	23.0	18.3	9.8	10.7	8.2	6.0	2.8	Do.
62953	....	....do	....do	♀	23.2	18.6	10.1	10.6	8.6	6.4	2.7	Do.
62434	....	....do	....do	♀	23.0	18.8	10.0	10.4	8.2	6.3	2.6	Do.
62962	....	....do	....do	♀	23.0	18.0	10.0	10.6	8.3	6.3	2.9	Do.
62430	....	....do	....do	♀	23.0	18.0	9.7	10.2	8.2	6.2	2.8	Do.
62954	....	....do	....do	♀	22.4	18.0	10.0	10.2	.....	6.0	2.5	Do.
43326	31461	Dept. Agric.	Steilacoom, Wash...	♂	22.5	18.3	10.0	10.4	8.0	5.7	3.0	Adult, or less.
43325	31460	....do	Tenino, Wash.....	♂	21.5	17.0	9.2	10.0	.....	6.0	2.6	Do.
65707	....	....do	Siskiyou, Oreg.....	♂	22.4	18.0	9.7	10.8	.....	6.0	2.7	Do.
24010	....	....do	Crescent City, Cal...	♂	23.2	18.0	9.6	11.0	.....	6.2	2.8	Youngish?
65322	....	....do	Carberry Ranch, Cal		.....	17.6	9.0	.....	8.2	6.0	2.6	Adult, or less.
1602	2585	Amer. Mus .	Nicasio, Cal.....	♀	24.0	.....	.....	11.2	.....	.....	.....	Do.
4993	1509	Merriam....	....do	♂	.....	.....	10.0	.....	.....	6.2	.....	Adult.

[1] The skull from Crescent City, California, retains the upper milk canine behind the permanent one on each side.

[2] Rept. Pacific R. R. Survey, VIII, 1857, p. 76, pl. XXVIII.

[3] Proc. Zool. Soc., 1880, p. 441, pl. XLII.

1. LIST OF THE PRINCIPAL GENERAL WORKS IN WHICH THE HABITS, ANATOMY, AND CLASSIFICATION OF THE AMERICAN MOLES ARE MORE OR LESS FULLY DISCUSSED.

1846–1854. AUDUBON, J. J., and BACHMAN, J.—The Viviparous Quadrupeds of North America. 3 vols. 4°. 1846–1854.

Contains descriptions of most of the species, together with extensive accounts of habits, and notes on distribution and taxonomy.

1859. BAIRD, S. F.—Mammals of North America; the descriptions of species based chiefly on the collections in the Museum of the Smithsonian Institution. 4°. 1859.

Contains descriptions of the majority of American species of moles, with measurements and lists of specimens and also figures of the skulls and principal external parts.

1842. DEKAY, JAMES E.—Zoology of New York, or the New York Fauna. Part I, Mammalia. 4°. 1842.

Contains descriptions and figures of *Scalops aquaticus* and *Condylura cristata*, and brief notes on habits.

1883. DOBSON, G. E.—A monograph of the Insectivora, systematic and anatomical. Part 2, including the families Potamogalidæ, Chrysochloridæ, and Talpidæ. 4°. 1883.

Includes full descriptions of the American moles, and an account of the anatomy of *Scalops*, *Scapanus*, and *Condylura*, and figures of the skulls, muscles, and viscera.

1869. FITZINGER, L. J.—Die natürliche Familie der Maulwurfe und ihre Arten, nach kritischen Untersuchungen.

<Sitzungsber. Math. Nat. Clas. K. Akad. Wissensch., Wien, (1) LIX, 1869, pp. 353–429.

1875. GILL, THEO.—Synopsis of Insectivorous mammals.

<Bull. Geol. and Geog. Survey of the Territories, No. 2, second series, 1875, pp. 91–120.

Comprises a review of the literature and classification of the insectivores, including American forms, together with brief bibliography of works relating to American moles and shrews.

1826–1828. GODMAN, JOHN.—American Natural History. Mastology. 3 vols. 8°. 1826–1828.

Contains descriptions of *Condylura cristata* and *Scalops aquaticus*, and an account of the habits of the latter.

1825. HARLAN, RICHARD.—Fauna Americana. 8°. 1825.

Includes descriptions of American moles.

1856. KENNICOTT, R.—Zoology of Illinois. The silvery shrew mole, or ground mole of Illinois—*Scalops argentatus*, And. & Bach.

<Prairie Farmer (newspaper), XVI, No. 50, Dec. 11, 1856.

1884. MERRIAM, C. H.—The Vertebrates of the Adirondack region.

<Trans. Linn. Soc., New York, II, 1884, pp. 48–65.
An important contribution to the natural history of *Condylura* and *Parascalops*.

1867. MIVART, ST. GEORGE.—Notes on the Osteology of the Insectivora.

<Journal of Anatomy and Physiology, I, 1867, pp. 281–312, II, 1867, pp. 117–154.

A general treatise on the osteology, odontology, and classification of the Insectivora, in which the American moles receive their due share of attention.

1863. PETERS W.—Über neue Eichornarten aus Mexico, Costa Rica und Guiana, so wie über *Scalops latimanus* Bachmann.

<Monatsber. K. Preuss. Akad. Wissensch. Berlin, 1863, pp. 652–656.

2. LIST OF THE PRINCIPAL WORKS RELATING CHIEFLY OR EXCLUSIVELY TO AMERICAN MOLES.

1884. ABBOTT, C. C.—Notes on Hibernating Mammals.

<Science (newspaper), III, 1884, p. 538.
Includes a reference to *Condylura cristata*.

1876. ANON.—Habits of the mole.

<Forest and Stream (newspaper), VI, 1876, p. 402.
A brief statement of the relation of the mole to horticulture.

1876. ANON.—[Holabird's moleskin fustian hunting suits.]

<Forest and Stream (newspaper), VI, 1876, p. 106.
In praise of moleskin hunting clothes.

1877. ANON.—The moles.

<Forest and Stream (newspaper), VIII, 1877, p. 114.
Notes on their extermination in Greenwood Cemetery, Brooklyn, N. Y.

1885. AYRES, H.—On the structure and development of the nasal rays in *Condylura cristata*.

<Biol. Centralblatt, IV, 1885, pp. 356–360.

1855. AYRES, W. O.—[On Scalops calfornicus, sp. nov.]

<Proc. Cala. Acad. Sci., I, May 1855, p. 54.

1841–42. BACHMAN, J.—Observations on the genus Scalops (shrew moles), with descriptions of the species found in North America.

<Proc. Boston Soc. Nat. Hist., I, 1841, pp. 40, 41 (abstract); Boston Journ. Nat. Hist., IV, No. 1, June, 1842, pp. 26–35.

1772. BARRINGTON, D.—Account of a mole from North America. In a letter to Dr. Maty, sec. R. S., from the Hon. Daines Barrington, F. R. S.

<Philos. Trans., LXI, 1772, pp. 292, 293.

1883. BELL, ROBERT.—The Causes of the Fertility of the Land in the Canadian Northwest Territories.

<Trans. Royal Soc. Canada, I, sect. 4, 1883, p. 157.
The erroneous theory advanced that the fertility is due to the presence of moles.

1857. [BILLINGS, E.]—On the star-nosed mole of America. [*Anon.*]

<Canad. Nat. and Geol., II, 1857, pp. 446–448.
A description and figure of the species and brief account of habits, chiefly from Godman and Harlan.

1820. BLAINVILLE, H. DE.—Sur le systeme dentaire du Sorex aquaticus, ou du genre *Scalops*.

<Bull. Sci., Soc. Philom., 1820, pp. 130–132. [Not seen.]

1883. BRACKETT, A. G.—The moles. (Talpidæ.)

<Amer. Field (newspaper), XIX, 1883, p. 130.
A general account of the habits of American moles.

1853. CASSIN, J.—[Exhibition of a new mole, Scalops metallescens.]

<Proc. Acad. Nat. Sci. Phila., VI, Feb., 1853, p. 242.
Notice (but no description) of a discolored specimen, afterwards named *Scalops æneus*, and equivalent to *Scapanus townsendi*.

1853. CASSIN, J.—Description of a new mole of the genus Scalops, from Oregon; a specimen of which is in the collection of the exploring expedition made by the U. S. ships Vincennes and Peacock, under the command of Capt. Charles Wilkes, of the United States Navy.

<Proc. Acad. Nat. Sci., Phila., VI, 1853, p. 299.
Description of *Scalops æneus*=*Scapanus townsendi*.

1875. COUES, E.—The silvery mole.

<Rod and Gun (newspaper), May 22, 1875. [Not seen.]

1877. COUES, E.—Precursory notes on American insectivorous mammals, with descriptions of new species.

<Bull. U. S. Geol. and Geog. Survey of the Territories, III, No. 3, 1877, pp. 631–653.
A preliminary revision of the American moles and shrews.

1879. COUES, E.—Note on the hairy-tailed mole, Scalops breweri of authors.

<Amer. Nat., XIII, 1879, p. 189.
Refers to the name "Talpa Americana Bartram MS.," occurring in Harlan's Fauna Americana.

1880. COUES, E.—Difference in the habits of Scalops aquaticus and Scapanus americanus.

<Amer. Nat., XIV, 1880, p. 53.
On the habits of the two species at Somerset, Mass.

1878. DEANE, RUTHVEN.—Deadly combat between an albino robin and a mole.

<Bull. Nuttall Ornith. Club, III, 1878, p. 104.
Account in a letter by Miss Maria R. Audubon.

1819. DESMAREST, A. G.—[On Condylura cristata.]

<Journ. de Physique, LXXXIX, 1819, p. 230. [Not seen. Fide Coues & Gill.]

1891. DOBSON, G. E.—Note on the derivation and distribution of the Insection of the new world.

<Proc. Zool. Soc. London, 1891, pp. 349–351.

1888. EVERMANN, B. W.—The occurrence in Indiana of the star-nosed mole (Condylura cristata L.).

<Amer. Nat., XXII, 1888, p. 359.
Specimen brought in by a cat at Denver, Miami County.

1871. FOWLER, A.—Woodcock and Moles.

<Amer. Nat., IV, 1871, p. 761.
States that the woodcock drives the common star-nosed moles from meadows by devouring the earthworms, etc., on which they feed.

1858. GIEBEL, C. G.—Osteologische Eigenthümlichkeiten des nordamerikanischen Wassermulls (Scalops aquaticus).

<Zeitsch. gesammt. Naturwiss. Halle, XII, 1858, pp. 395–405.

1825. GODMAN, J. S.—Note on the genus Condylura of Illiger.

<Journ. Acad. Nat. Sci. Phila., V, 1825, pp. 109–116; Philos. Mag., LXVII, 1826, pp. 273–277; Isis, 1834, pp. 475–477.
A detailed description of the external characters of *Condylura* and on the thickening of the tail, together with notes on the other American genera.

HARRIS, T. W.—.[A purple species of mole.]

<New England Farmer (newspaper). [Not seen. Fide LeConte.]

1825. HARRIS, T. W.—Description of a nondescript species of the genus Condylura.

<Boston Journ. Philos. and Arts, II, 1825, pp. 580 to 583; Tilloch's Philos. Mag., LXVII, 1826, pp. 191–193; Ferussac's Bull. Sci. Nat., VIII, 1826, pp. 97, 98.
Description of *C. prasinata=C. cristata.*

1856. KENNICOTT, R.—Zoology of Illinois. The silvery shrew mole or ground mole of Illinois—Scalops argentatus, Aud. & Bach.

<Prairie Farmer (newspaper), XVI, No. 50, Dec. 11, 1856. [Not seen.]

1853. LECONTE, J.—[Remarks on the specimens of moles in the collection of the Philadelphia Academy.]

<Proc. Acad. Nat. Sci. Phila., VI, June 1853, pp. 326, 327.
Returns the moles of the genera *Scalops*, *Scapanus* and *Parascalops* to the European genus *Talpa*, and describes two nominal American species, *T. tæniata* and *T. pennantii*.

1864. LORD, J. K.—Notes on the Urotrichus.

<Proc. Zool. Soc. London, 1864, pp. 161-163.

On the habits of *Neürotrichus* at the Fraser River, British Columbia.

1883. OLMSTED, L. H.—Ground moles; their habits, and how to catch them. 16°. Pp. 1-12, 1883.

1832. RAFINESQUE, C. S.—On the moles of North America and two new species from Kentucky.

<Atlantic Journal, 1832, p. 61.

1871. TENNEY, S.—The star-nosed mole.

<Amer. Nat., V, 1871, p. 314.

On its appearance in winter on the snow at Niles, Michigan.

1895. TRUE, F. W.—The proper name for Brewer's mole.

Science, new ser., I, 1895, p. 101.

1835. WOODRUFF, S.—The mole (Scalops canadensis, Cuv.) carnivorous.

<Amer. Journ. Sci. and Arts, XXVIII, 1835, pp. 168-171.

A repetition of Flourens' experiments, proving that the American mole, *S. aquaticus*, is as exclusively carnivorous as the European mole.

EXPLANATION OF PLATES.

[Figures all one and one-half times natural size.]

PLATE I.

Fig. 1. *Scalops aquaticus machrinus.* No. 36555, U. S. N. M. Male, adult. Warsaw, Ill.

Fig. 2. *Scalops aquaticus texanus.* No. $\frac{5124}{6515}$, Amer. Mus. Female, adult. Rockport, Tex.

Fig. 3. *Scalops aquaticus.* (Typical.) No. 4851, U. S. N. M. Adult. Carlisle, Pa.

Fig. 4. *Scalops aquaticus australis.* No. 2990, Amer. Mus. Adult. Gainesville, Fla. (Type of the subspecies.)

Fig. 5. *Scapanus anthonyi.* No. 4947, Amer. Mus. Male, adult. San Pedro Martir Mountains, Lower California. (Type of the species.)

Fig. 6. *Scapanus californicus.* No. 3111, U. S. N. M. Adult. San Francisco, Cal.

Fig. 7. *Scapanus californicus.* No. 65187, Dept. of Agric. Male, adult. Nicasio, Cal.

Fig. 8. *Scapanus orarius.* No. 3480, Miller Coll. Female, adult. Sumas, British Columbia.

Fig. 9. *Scapanus townsendi.* No. 43330, Dept. of Agric. Male, adult. Tenino, Wash.

PLATE II.

Fig. 1. *Scalops aquaticus machrinus.* No. 36555, U. S. N. M. Male, adult. Warsaw, Ill.

Fig. 2. *Scalops aquaticus texanus.* No. $\frac{5124}{6515}$, Amer. Mus. Female. Rockport, Tex.

Fig. 3. *Scalops aquaticus.* (Typical.) No. 4851, U. S. N. M. Adult. Carlisle, Pa.

Fig. 4. *Scalops aquaticus australis.* No. 2990, Amer. Mus. Adult. Gainesville, Fla. (Type of the species.)

Fig. 5. *Scapanus californicus.* No. 1286, Merriam Coll. Fort Klamath, Oreg. (Type of *S. dilatus.*)

Fig. 6. *Scapanus anthonyi.* No. 4947, Amer. Mus. Male, adult. San Pedro Martir Mountains, Lower California. (Type of the species.)

Fig. 7. *Scapanus californicus.* No. 65184, Dept. of Agric. Male, adult. Nicasio, Cal.

Fig. 8. *Scapanus orarius.* No. 3480, Miller Coll. Female, adult. Sumas, British Columbia.

Fig. 9. *Scapanus townsendi.* No. 43330, Dept. of Agric. Male, adult. Tenino, Wash.

Fig. 10. *Scapanus californicus.* No. 1286, Merr. Coll. Adult. Fort Klamath, Oreg. (Type of *S. dilatus.*)

PLATE III.

Fig. 1. *Scalops aquaticus machrinus.* No. 36555, U. S. N. M. Male, adult. Warsaw, Ill.
Fig. 2. *Scalops aquaticus texanus.* No. $\frac{4}{6}\frac{1}{5}\frac{2}{1}\frac{3}{2}\frac{4}{3}$, Amer. Mus. Female. Rockport, Tex.
Fig. 3. *Scalops aquaticus.* (Typical.) No. 4851, U. S. N. M. Adult. Carlisle, Pa.
Fig. 4. *Scalops aquaticus australis.* No. 2990, Amer. Mus. Adult. Gainesville, Fla. (Type of the subspecies.)
Fig. 5. *Scalops aquaticus australis.* No. 1468, Rhoads Coll. Tarpon Springs, Fla. (Type of *S. parvus.*)[1]
Fig. 6. *Scapanus anthonyi.* No. 4947, Amer. Mus. Male, adult. San Pedro Martir Mountains, Lower California. (Type of the species.)
Fig. 7. *Scapanus californicus.* No. 3111, U. S. N. M. San Francisco, Cal.
Fig. 8. *Scapanus californicus.* No. 65187, Dept. of Agric. Male. Nicasio, Cal.
Fig. 9. *Scapanus orarius.* No. 3480, Miller Coll. Female, adult. Sumas, British Columbia.
Fig. 10. *Scapanus townsendi.* No. 43330, Dept. of Agric. Male, adult. Tenino, Wash.

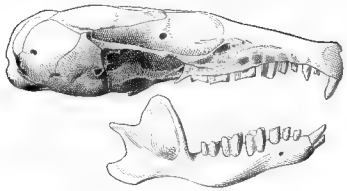
PLATE IV.

Figs. 1–3. *Parascalops breweri.* No. 57086, Dept. of Agric. Female. Magnetic City, N. C.
Figs. 4–6. *Condylura cristata.* No. 1012, Merriam Coll. Female, adult.
Figs. 7–9. *Neürotrichus gibbsii.* No. 65707, Dept. of Agric. Male. Siskiyou, Oreg.

[1]This figure was made under the supervision of Mr. Rhoads, by Mr. Von Iterson, in Philadelphia. All the others are by Dr. J. C. McConnell, and were corrected by myself. The text figures were drawn by Mr. A. H. Baldwin.

SKULLS OF AMERICAN MOLES.

SKULLS OF AMERICAN MOLES.



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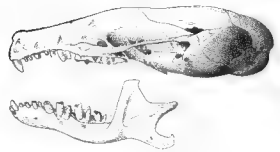

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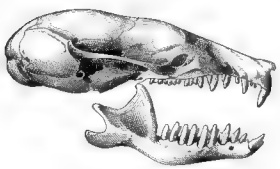

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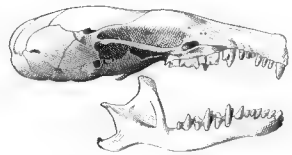

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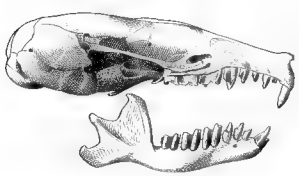

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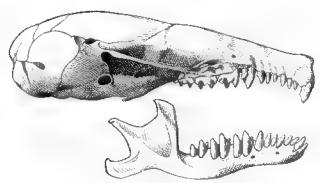

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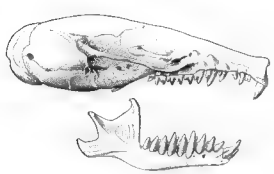

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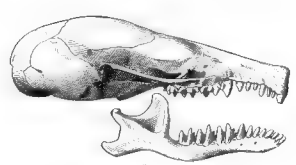

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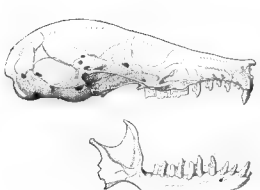

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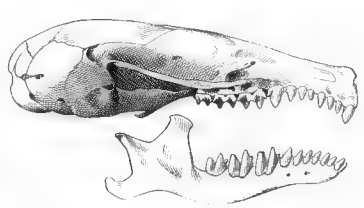

10

SKULLS OF AMERICAN MOLES.

SKULLS OF AMERICAN MOLES.

DESCRIPTIONS OF NEW CYNIPIDOUS GALLS AND GALL-WASPS IN THE UNITED STATES NATIONAL MUSEUM.

By WILLIAM H. ASHMEAD,

Honorary Custodian of Hymenoptera.

THE present paper represents part of a report prepared several years ago entitled "Report upon the Cynipidous Galls and Gall-Wasps in the United States National Museum."

The manuscript of same was handed to the late Dr. C. V. Riley for publication in the Proceedings of the National Museum, but for various reasons it was never submitted by him for publication, and has only been returned to me since his death.

During the time the manuscript was in his hands two other American students of the Cynipidæ, Mr. Homer F. Bassett, of Waterbury, Connecticut, and Prof. C. P. Gillette, of Fort Collins, Colorado, have published descriptive papers upon the family, and I now find many of the species, first described in my manuscript, are preoccupied by these authors.

The following forty-three gall-making species are, however, so far as I know, still undescribed, and may be recognized from the following descriptions:

Genus TRIGONASPIS, Hartig.

1. TRIGONASPIS RADICIS, new species.

Gall.—An irregularly rounded, rugose, fleshy gall, occurring in clusters on the roots of an unknown oak in Utah.

The color of the dried specimen is now brown, although a label says: "Large, soft, white galls, purple on top." They measure 1 cm. in length, by 6 mm. in diameter.

Gallfly.—Female. Length, 4.2 mm. Head yellow; ocelli and eyes black; thorax reddish piceous, varied with dark brown on mesonotum; metathorax, antennæ, middle and posterior tibiæ and abdomen dark brown, the latter almost black; legs reddish yellow.

Stature similar to *T. megaptera*. Head minutely confluently punctate; antennæ long, filiform, pubescent, the third joint not quite twice as long as the fourth, the two basal joints pale. Thorax polished with

two broad parapsidal grooves, the margins of which are rounded. Scutellum coarsely rugose, elevated posteriorly and projecting over the metathorax. Mesopectus black. Mesopleura polished, the triangular part beneath the wing punctate and hairy. Metanotum and metapleura rugoso-punctate. Abdomen smooth, shining, more or less black dorsally, at base and beneath reddish brown; petiole short. Wings large, hyaline, the pubescence short and indistinct, veins brownish, the areolet and cubital cell closed.

Male.—Length, 3.2 mm. It differs from female only as follows: Head, thorax, and abdomen entirely black, the latter being small triangular; the antennæ longer, 15-jointed, the third joint long, slightly bent and excised at the middle, thickened at tips, while all the legs are reddish yellow.

Type.—No. 561, U.S.N.M.

Described from 5 specimens—4 female, 1 male—labeled Utah, June 20, 1885. In my own collection are many specimens of this species collected by Mr. E. A. Schwarz at American Fork Canyon, Alta, Milk Creek, Salt Lake, and Wasatch, Utah, during the month of June, 1893.

Genus DRYOPHANTA, Förster.

2. DRYOPHANTA VESICULOIDES, new species.

Gall.—In size, color, and general appearance exactly similar to the gall produced by *D. vesicula*, Bassett; I can detect no difference, but, whereas that species is developed from the buds of *Q. alba*, this one is developed from the buds of *Q. obtusiloba*. This, in itself, would not be a sufficient reason for considering it a distinct species, but the gallfly which issues therefrom is very distinct and much smaller.

Gallfly.—Female. Length, 1.4 mm. Black, polished, the antennæ yellowish, obfuscated toward tips; legs yellowish, the coxæ at base, all femora in the middle, and posterior tibiæ obfuscated or brownish. Antennæ 14-jointed, long, nearly the length of the body, the third joint one-third longer than fourth, the eight terminal joints short but widened. Thorax short, broad, the parapsidal grooves distinct, slightly converging posteriorly; pleura smooth; scutellum minutely rugose, rounded, convex, the foveæ small but distinct. Abdomen broader vertically than long, compressed, the ventral valve slightly exserted, testaceous. Wings hyaline, pubescent, the veins pale yellowish; the cubital cell is almost closed, but the cubitus is very pale and indistinct.

Male.—Length, 1.8 mm. In colorational detail like the female, but the antennæ are 15-jointed, yellowish, the third joint as long as the two basal joints united, straight, but slightly thickened apically; the scutellum differs in being smooth and polished; while the abdominal petiole is short, and the legs are a little darker or more obfuscated than in the female.

Type.—No. 3057, U.S.N.M.

Four specimens—1 male, 3 females, reared May 10, 1883—received from J. G. Barlow, Cadet, Missouri.

3. DRYOPHANTA EMORYI, new species.

Gall.—A small, brown, thin-shelled, semiglobular gall, attached by a small point to the upper or under surface of a leaf of *Quercus emoryi*. Internally there is a small, central kernel, held in place by delicate filamentary fibers. Diameter, 2 to 3 mm.

Gallfly.—Female, length, 2 mm. Form rather slender, polished black; antennæ and legs dark brown, almost black, the articulations and tarsi dark honey-yellow or slightly reddish. The head and thorax are covered with long sparse pile; lower part of face with some coarse punctures, and a poorly defined median ridge. The antennæ extend to base of the abdomen, pubescent, 14-jointed, the third joint more than one-third longer than the fourth; flagellar joints three, four, five, and six, are rounded at apex; the others are short, slightly widened and truncate at apex, but narrowed and rounded at base, the terminal joint one-third longer than the preceding, fusiform.

The thorax has two broad, distinct, parapsidal grooves; scutellum minutely rugose, elevated and rounded posteriorly, but with a small, smooth, shining spot on the disk; at base it is transversely depressed and apparently without the usual foveæ; if they exist they are small. The mesopleura are smooth, shining, but when carefully examined a few striæ can be detected anteriorly and basally. The abdomen is large, polished, longer than the head and thorax together, compressed, and, when viewed from the side, obovate in outline; the ventral valve projects considerably, and is armed and hairy. Legs rather densely pubescent. Wings long, hyaline, pubescent, the veins strongly developed, dark brown, slightly piceous.

Type.—No. 3058, U.S.N.M.

Three specimens, reared December 13, 1880, from the above-described gall; collected by Mr. H. H. Rusby, at Silver City, New Mexico.

4. DRYOPHANTA PULCHRIPENNIS, new species.

Gall.—The specimens of the gall from which this species was reared can not now be found in the collection, but the following description of it, taken from the department records, may assist in its identification:

Received from Mr. H. H. Rusby, from Arizona, a leaf of an undetermined oak with six galls on its under surface: four of these are in a row in the middle between the midrib and the margin; they are light brown, almost hemispherical, subopaque, reticulate, and with scattered, very minute, reddish tubercles, which have some short white hairs basally.

Gallfly.—Female. Length, 1.8 to 2 mm. Brownish yellow, the second abdominal segment apically dark brown. In one of the two specimens in the collection, the mesonotum, scutellum, and metathorax are brownish; eyes, ocelli, and ungues dark brown. Head, thorax, and pleura smooth, shining; the head much wider than the thorax and thick antero-posteriorly. Antennæ about as in *D. emoryi*, the fourteenth joint, however, not being distinctly separated from the thirteenth,

connate. Mesonotum short, nearly as broad as long, with two parapsidal grooves, but not as distinct as usual in the genus.

Abdomen as long as the head and thorax together, compressed, when viewed from the side, truncate behind; the ventral valve projects very considerably and is armed with an unusually long, hairy spine, half the length of hind femur. Wings hyaline, the front wings being beautifully clouded or spotted with brown blotches as follows: A blotch in the cubital cell near the basal vein, one at the break in the anal vein, one in the cell formed by this vein and the branch of the cubitus which extends to the apical margin, and in the space known as the second submarginal cell are two blotches, one near the apex, the other at the base, the last inclosing the whole tip of the radius. Veins brown, the radius slightly thickened at tip; the vein at base of radial cell slightly clouded.

Types.—No. 3059, U.S.N.M.

Two female specimens, reared during April, 1881.

5. DRYOPHANTA RADICOLA, new species.

Gall.—This gall also could not be found in the collection. The Note Book says:

Received from J. G. Barlow, Cadet, Missouri, one much shriveled gall, found on the roots of scrub oak.

Gallfly.—Female. Length, 3 mm. Brick-red, antennæ pale, brownish toward tips; eyes brown-black.

Head minutely, confluently punctate; collar rugose; disk of mesopleura smooth, polished; mesonotum smooth, polished, the two parapsidal grooves broad and well defined; scutellum cushion-shaped, coarsely, reticulately rugose, with two transverse, nearly confluent, foveæ at base. Wings hyaline, veins blackish, the areolet and cubital cell distinct.

Type.—No. 3060, U.S.N.M.

Described from one female specimen, reared May 21, 1886.

Genus ANDRICUS, Hartig.

6. ANDRICUS MORRISONI, new species.

Gall.—An irregular, globular gall, found at the base of a leaf, projecting about equally above and below; polythalamous. It is of a fleshy consistency and contains numerous larval cells; diameter from 4 to 7 mm.

Gallfly.—Female. Length, 2 mm. Head, thorax, and legs brown; the space surrounding eyes, antennæ, and anterior tibiæ, yellowish, the abdomen black. Antennæ 13-jointed, the terminal joint very long. Head, thorax, pleura, and scutellum minutely, rugosely punctate; parapsidal grooves subobsolete, the short anterior median grooves deeply impressed at tips and the line on the shoulders distinct. Wings hyaline, veins

yellowish, the areolet distinct, while the cubital cell is closed for two-thirds of its length. The black abdomen is delicately, reticulately sculptured.

Male.—Length, 1.6 mm. Entirely black, the antennæ and legs pale yellow. Antennæ long, 15-jointed, the third joint slightly curved; thorax finely, reticulately punctate, without grooves, the abdomen small and pedunculated.

If the female had remained unknown, this species would have been placed in the genus *Neuroterus*, the male agreeing more closely in its structural characters with that genus than with *Andricus*.

Type.—No. 3061, U.S.N.M.

Described from 1 female and 7 male specimens, reared June 28, 1883, from a gall occurring on an unknown oak in Arizona, received from H. K. Morrison.

7. ANDRICUS MURTFELDTÆ, new species.

Gall.—An irregular, hard, pithy, brown, globular gall; externally finely granulated and with a few short blunt spines; interiorly of a hard, pithy, brown substance; polythalamous. Diameter, 8 mm.; length, 10 mm.

Gallfly.—Male. Length, 2.6 mm. Head, thorax, and abdomen black, subopaque, the abdomen along the venter and at apex brownish; antennæ and legs, including coxæ, yellowish brown, the posterior pair slightly obfuscated; ocelli red; eyes brown; tegulæ and veins of wings brown, the basal vein and apical portion of the submarginal from it, and the angulated vein at base of marginal cell, blackish.

Head and thorax finely, confluently punctate, scutellum rugose, pleura punctate and slightly striate. Antennæ 15-jointed, rather long, the third joint longest, the following joints slightly oval, and delicately fluted; the antennæ are more yellowish than the legs. Parapsidal grooves slender but sharply defined; two short median grooves anteriorly and a slight indication of a median groove posteriorly, the groove on the shoulders distinct. Wings hyaline, pubescent, the veins very distinct, the cubital cell and areolet closed.

Type.—No. 3062, U.S.N.M.

Described from 3 male specimens with the gall, labeled simply from Miss Murtfeldt, and probably taken at Kirkwood, Missouri.

8. ANDRICUS DASYDACTYLI, new species.

Gall.—This gall, in structure, is very peculiar, and consists of an oblong or elongated, woody tube, in shape not unlike a date seed; it is 2 centimeters long by from a half to three-quarters of a centimeter in diameter, one end being attached sessilely to the branch and covered with long, brownish-yellow wool. Internally there is a cylindrical hollow, which, however, does not extend its entire length, being interrupted or stopped up by the small larval cell which is situated near its center.

Sometimes three or more of these galls occur close together on the branch, and with their woolly covering present a curious appearance. One specimen in the collection is almost globular, but all the others are as described above.

Gallfly.—Female. Length, 3.8 mm. Clear reddish brown; vertex of head and the extreme tip of abdomen dusky; antennæ and legs brownish yellow.

Head and thorax minutely, finely punctate, the pleura with fine striæ. Antennæ 14-jointed, rather long, the third joint one-third longer than fourth, the following to eighth gradually shortening, beyond this about equal, the terminal joint being slightly lengthened. The parapsidal grooves are only distinct on the posterior half of the mesonotum, entirely wanting anteriorly; anteriorly extending to about the middle of the mesonotum are two median, glabrous lines; posteriorly there is a long median grooved line, while the line on the shoulders is distinct; the scutellum is more coarsely rugose at the apex, the basal foveæ large, ovate, oblique, approximate, glabrous at bottom. The abdomen is slightly longer than the head and thorax together and of the usual shape. Wings glassy hyaline, only slightly pubescent, the veins pale yellowish, except the basal nervure and the vein at base of marginal cell, which are brown; this last vein is arcuate but not angulate. The areolet is large and the cubital cell is not quite closed.

Type.—No. 3063, U.S.N.M.

Described from many female specimens, which issued at various dates betwe n January 18, 1885, and February 11, 1886. The gall occurs in California on *Quercus chrysolepis*, and was sent to the Department of Agriculture by Mr. Albert Koebele.

9. ANDRICUS PACIFICUS, new species.

Gall.—An irregular, globular gall, almost round, or then with the apex acuminate and the base, or where the gall is attached to the twig, narrowed and elongated. It is of a light brownish-yellow color, smooth, and, in two or three specimens, slightly polished; internally it is of a hard, pithy structure with a distinct, large larval cell; diameter variable, from 6 to 16 mm. The great variation in size may be occasioned by the smaller ones being deformed or parasitized specimens.

Gallfly.—Female. In stature, color, and markings this species can not be separated from *A. dasydactyli*, yet the gall produced by it is entirely different, and it must necessarily be distinct, but after the closest study I am unable to seize a single character that will separate the flies, and the gall must be relied upon to separate the two species.

Types.—No. 3064, U.S.N.M.

Two female specimens of the flies, received from Mr. Albert Koebele, Placer County, California, who found them growing in *Quercus chrysolepis*.

10. ANDRICUS WISLICENI, new species.

Gall.—A small, globular gall, with a slight projection at base where it is attached to the twig; it varies in color from a yellow brown to dark brown, and some are mottled with purple and brown. It is hard, and contains in the center a small larval cell; diameter, 3 to 4 mm.

Gallfly.—Female. Length, 3 to 3.4 mm. Pale brownish yellow, almost devoid of pubescence, the abdomen polished and discolored with brown, eyes dark brown, the mandibles black.

Head and thorax finely punctate, shining; in front of the anterior ocellus is a deep transverse fovea, and there are some coarse scattered punctures on the mesonotum. Antennæ 14-jointed, the third joint about one-fourth longer than the fourth, the joints, from seventh to apex, short, about twice as long as wide, dusky, and delicately fluted. Parapsidal grooves distinct, the groove on the shoulders very long, distinct, and a little bent anteriorly. Scutellum cushion-shaped, rugose, the foveæ at base large and distinct, separated only by a slight carina; pleura smooth, but under a high power, showing faint delicate striæ. Wings hyaline, the pubescence short, veins, except the submarginal vein from the portion extending from the basal vein to apex, and the angulated cross vein at base of marginal cell, which are brownish or piceous, yellowish.

Type.—No. 3065, U.S.N.M.

Nine female specimens, reared October 14, 1886, from the galls sent to the National Museum by Mr. Albert Koebele, collected in Sacramento County, California, on *Quercus wisliceni*.

11. ANDRICUS CHRYSOLEPIDIS, new species.

Gall.—A very hard, ovate, or globular gall, with a nipple at apex and a centrally embedded larval cell; externally it is covered with a dense, fine, short pubescence like the pubescence on a peach, although sometimes this is rubbed off. Diameter, 5 to 8 mm.

Gallfly.—Female. Length, 3 to 5 mm. Reddish brown, antennæ and legs brownish yellow, eyes and abdomen dark, reddish brown.

Head and thorax closely punctate, sparsely pubescent. Antennæ 14-jointed, very slightly thickened at tips. The thorax, besides the two parapsidal grooves which are obsolete anteriorly, has a median groove extending anteriorly for more than half the length of the mesonotum, two short median grooves anteriorly on each side of this, and the usual groove on the shoulders. Scutellum cushion-shaped, rugose, the foveæ distinct; pleura finely, minutely rugose, slightly striated at base. Abdomen polished, the short apical segments under a high power show a fine, delicate punctuation, while the ventral valve projects but slightly. Wings glassy hyaline, veins yellowish, areolet small; neither the apex of the submarginal nor the radial vein reach the margin.

Types.—No. 3066, U.S.N.M.

One female, reared from a gall found on *Quercus chrysolepis*, at Colfax, Placer County, California, October 8, 1885, by Mr. Albert Koebele; and two specimens reared January 18 and 29, 1886, from same galls. Other of the galls are No. 3816, U.S.N.M.

12. ANDRICUS APICALIS, new species.

Galls.—Irregular, brownish black globular galls of a dense pithy substance, growing on the roots of *Quercus wislizeni*, sometimes three or four together, pressing each other into irregular shapes. Diameter usually about half an inch.

Gallfly.—Female. Length, 5.8 to 7 mm. Bright brick red, the mandibles black at tips. Head and thorax finely punctate with some larger, coarser punctures scattered over the surface, and almost free from pubescence. Cheeks full, bulging. Antennæ 14-jointed, filiform, the third joint slightly longer than fourth and narrowed toward base, the apical joint twice as long as the preceding, fusiform.

Parapsidal grooves distinct, a more or less distinct medial groove and distinct grooved lines on the shoulders. Scutellum rugose, with two large foveæ at base, separated by a carina; pleura anteriorly slightly rugose, posteriorly nearly smooth, with some very delicate striæ. Abdomen smooth, with a few hairs on the side of second segment; the terminal segments show a fine, delicate punctuation; the spine of the ventral valve is long. Wings hyaline, except the entire apical third, which is smoky or dark brown, the veins stout, black, the angular projection in marginal cell at base being very distinct.

Type.—No. 3067, U.S.N.M.

Three specimens, reared by Mr. Albert Koebele, from galls collected in Sacramento County, California, but the year of collecting and the date of rearing are not given. A single specimen (No. 3714) was reared February 17, 1886. The bright red color and smoky apices of wings will readily distinguish the species.

13. ANDRICUS CONGREGATUS, new species.

Gall.—An irregular, rugose, yellowish brown woody swelling, containing numerous cells growing apparently from the extreme tips of very slender twigs of *Quercus chrysolepis*, the gall appearing to have a long peduncle, or it may be at the apex of the petiole of a leaf, the leaf in consequence being aborted. The gall is more or less contracted in the middle and varies in length from 2 to 4 cm., and in diameter from 1 to 2 cm.

Gallfly.—Female. Length, 2 mm. Pale brown or brownish yellow, the eight terminal antennal joints, the middle and posterior tibiæ, metathorax, abdomen dorsally, and wing veins brown.

Head and thorax closely, uniformly punctate. Antennæ 14 or 15 jointed, depending upon whether the terminal joint, which presents a rather distinct suture, is counted as one or two joints. The terminal

joints all appear delicately fluted. Mesonotum has three distinct grooves, extending its whole length, and the groove on the shoulder is long. Scutellum minutely rugose, the foveæ oblique, distinct, but rather widely separated. Wings hyaline, with short pubescence.

Type.—No. 3068, U.S.N.M.

Seven female specimens, received from Prof. E. W. Hilgard, Oakland, California, and reared November 10, 1876. The gall also occurs on *Quercus agrifolia*, and Professor Riley says: "A woody deformation of staminate aments and quite abundant on some trees."

14. ANDRICUS EXCAVATUS, new species.

Gall.—In the branches of the red oak, *Quercus rubrum*, toward the end of summer, appear long longitudinal slits or fissures, filled with irregularly shaped cells or kernels, which are usually smooth and polished, and generally of an oval, flattened form. These are the larval cells of a Cynipid, which fall to the ground in the fall, where the larvæ within undergo their final transformation.

After the larval cells have fallen to the ground from their matrices, the twigs present broad grooves, fissures, and excavations, the relative length, depth, and appearance depending entirely upon the number of cells they had contained. One twig in the collection of the National Museum from which these larval cells had fallen exhibits a broad excavation over 2 inches long.

The flattened larval cell varies considerably in shape and size, but usually it is from 5 to 6 mm. long by 3 to 5 mm. in diameter.

Gallfly.—Female. Length, 3 to 3.4 mm. Reddish brown, the antennæ, eyes, posterior tibiæ, metathorax, and dorsum of abdomen dark-brown. Head and thorax finely punctate. Antennæ 14-jointed, pubescent; mesonotum with three distinct grooves and anteriorly between the median and lateral grooves are two short grooves, the groove on the shoulders distinct. Scutellum rugose, rounded posteriorly, the foveæ confluent, polished. Wings hyaline, veins brownish yellow.

Type.—No. 3069, U.S.N.M.

Three female specimens, in poor condition, reared June 6, 1883. The gall was collected somewhere in the New England States. I have, however, collected the same gall in North Carolina.

1 ANDRICUS RILEYI, new species.

Gall.—A small brown globular gall, attached by a slender point to the midrib of a leaf. Diameter a little over 3 mm. The shell is very thin and brittle and the larval cell occupies the whole of the interior.

Gallfly.—Female. Length, 3.2 mm. Head, antennæ, and thorax brick red, legs and abdomen pale brown, eyes dark brown, tegulæ yellowish. Antennæ 14-jointed, finely pubescent, more especially toward tips. Head and thorax minutely punctate. Parapsidal grooves distinct, an indication of a median groove and two short median grooves

anteriorly which extend to the middle of the mesonotum, the groove on the shoulders long, distinct. Scutellum rugose, foveæ large, confluent; mesopleura punctate, except a small, smooth, glabrous spot just beneath the insertion of wings. Abdomen shining, with a few hairs on side of the second segment near the base. Wings hyaline, pubescent, veins brown, areolet and cubital cell closed; the radius extends to the margin, but not the apex of the submarginal vein. At base of the marginal cell is a small, slightly dusky cloud.

Type.—No. 3070, U.S.N.M.

One female specimen, reared at St. Louis, Missouri, by Dr. C. V. Riley, July 2, 1877. The gall occurs on *Quercus rubrum*.

16. ANDRICUS PERPLEXUS, new species.

Gall.—A small globular gall, somewhat pointed at apex and covered externally with an exceeding fine, short, grayish pubescence or bloom. Internally the larval cell occupies most of the gall. Diameter, 5 mm.

Gallfly.—Female. Length, 2.8 mm. Head, antennæ, legs—except the middle and posterior tibiæ, which are dark brown—and collar pale brown, eyes and thorax dark brown, pleura and abdomen black, shining. Antennæ 15-jointed, pubescent, the terminal joints slightly incrassated. Head and thorax minutely confluently punctate; parapsidal grooves distinct, two short median grooves anteriorly and the usual groove on the shoulders. Scutellum rugose, rounded, the foveæ at base large, deep, and approximate. The abdomen is of the usual shape with only a few sparse hairs on the side of the second segment. Wings hyaline, pubescent, veins brownish, the submarginal and median veins basally yellowish. The areolet is exceedingly small, contracted, almost obsolete, cubital cell closed, the vein at base of marginal cell a little angulated.

Type.—No. 3071, U.S.N.M.

One specimen, reared November 21, 1877. The gall was found on the ground in O'Fallen Park, Missouri, in October, and the species of oak upon which it grows is unknown.

17. ANDRICUS IMBRECARIÆ, new species.

Gall.—A brownish, hard, globular gall, from 7 to 10 mm. in diameter, issuing, usually several together, from a fissure in a twig of *Quercus imbrecaria* and *Q. ilicifolia*. The larval cell is nearly always closely cemented to the thick, hard, outer rind, but in a single instance there are a few fibers separating it.

Gallfly.—Female. Length, 4.6 mm. Variable in color from a pale brown to a reddish brown; eyes dark brown; the antennæ dusky or black toward tips. Head and thorax shining, but with a delicate punctuation. Antennæ 14-jointed, sparsely pubescent, the terminal joints delicately fluted. Parapsidal grooves of mesonotum distinct, broadened posteriorly. The longitudinal median groove posteriorly is

wanting, but anteriorly are two short median grooves, and there is the usual groove on the shoulders. Scutellum coarsely rugose, with two broad, approximate foveæ at base, separated by a slight carina. Pleura punctate. Abdomen polished, but wholly covered with an exceedingly fine, delicate punctuation. Wings glassy, hyaline; veins thick, piceous.

Type.—No. 3072, U.S.N.M.

Three female specimens, collected at St. Louis, Missouri, by Dr. Riley; one reared September 6, 1876; two reared October 12, 1881.

Genus CYNIPS, Linnæus.

18. CYNIPS FLAVICOLLIS, new species.

Female.—Length, 4.4 mm. Head and collar brownish yellow, mesonotum, scutellum, and mesopleura black, abdomen reddish brown, the apices of segments dusky, antennæ and legs dark brown. The head and thorax are finely punctate and the whole insect is covered with long grayish pubescence, the dorsum of the abdomen alone being bare. Head dusky on vertex; mandibles bluntly bidentate. Antennæ 14-jointed, a little thickened at tips, the third joint longer than scape and pedicel together; joints 10, 11, 12, and 13 only slightly longer than thick.

The grooves on the thorax can be distinctly detected through the pubescence; two short median grooves anteriorly and a coarse groove on the shoulders. Scutellum minutely rugose, with two approximate, not deep, foveæ at base. The abdomen is longer than the head and thorax together, much compressed, the ovipositor sheaths projecting black, the spine of the ventral valve not quite as long as the terminal tarsal joint.

Wings hyaline, pubescent, veins dark, piceous or brown; the angulation of the vein at base of marginal cell is long and very acute, areolet large, the cubital cell open at base.

Type.—No. 3073, U.S.N.M.

Described from one female specimen labeled simply "S. V. Summers," and probably collected in Illinois. The brownish-yellow head and collar will readily separate this species from all others in the genus.

19. CYNIPS SULCATUS, new species.

Female.—Length, 3 to 4 mm. Head, thorax, and legs, including coxæ, brownish yellow, abdomen and posterior tibiæ dark brown, eyes black, antennæ amber-colored and slightly dusky toward apex. Head closely punctate, thorax sparsely punctate, with slight wavy aciculations, pubescent. Antennæ 15-jointed, rather long, the third joint very long, one-third longer than the fourth, the following joints gradually subequal, the last being slightly longer than the preceding. The parapsidal grooves are abbreviated anteriorly; two short median grooves anteriorly and the grooves on the shoulders are surrounded by dusky bands. The scutellum, as well as the thorax, the abdomen, and the legs, are well

covered with a glittering whitish pubescence. The abdomen is hardly as long as the head and thorax together, and is closely longitudinally grooved or striated; the ovipositor sheaths are not visible and the spine of the ventral valve is very short. Wings hyaline or very slightly tinged with fuscous, the veins brown, distinct; the areolet is large, triangular, the cubital cell closed, while the basal vein of radial cell is but slightly angulated.

Type.—No. 3074, U.S.N.M.

A dozen or more specimens, reared March 28 to April 4, 1882, from a gall found on the live oak at Fort Grant, Arizona, by H. K. Morrison. Unfortunately the gall could not be found in the collection, and the following is all the Record Book has concerning it:

March 21, 1882.—Received from H. K. Morrison two galls on petiole of live oak; they are irregularly roundish and are about the size and color of a large dried pea.

The longitudinally striated abdomen will at once distinguish the species from all others in our fauna.

20. CYNIPS CHRYSOLEPIDICOLA, new species.

Gall.—An irregular, swollen enlargement, surrounding a twig or branch of *Quercus chrysolepis*, exactly similar to the gall *Andricus medullæ*, Ashmead, and indistinguishable from it. It varies in length from half an inch to one inch and a half or more.

Gallfly.—Female. Length, 2 to 3 mm. Pale brown, eight terminal joints of antennæ, metathorax, eyes and ocelli, and the prosternum black or brown black, the dorsum of abdomen dusky.

Head, thorax, and scutellum finely, closely punctate and sparsely covered with a yellowish pubescence. The antennæ are long, 15-jointed, pubescent, fourth, fifth, sixth, seventh, and eighth joints long, subequal with the long third joint; beyond these the joints are short, about twice as long as thick. The parapsidal grooves are obsolete anteriorly, and between them is a median groove extending nearly the whole length of the mesonotum, and two short, median, glabrous lines anteriorly; the groove on the shoulders is short. The pubescence on the thorax and scutellum is often quite dense, and the cheeks are prominent and bulging. The abdomen is greatly compressed, almost free from pubescence, the second segment not occupying half its length, all the following segments distinctly visible, *the ovipositor curving around upon the middle of the back.* Wings hyaline, veins pale brown, the areolet large, the cubital cell closed, the vein at base of radial cell angulated.

Type.—No. 3075, U.S.N.M.

Many specimens, received from Mr. Albert Koebele, collected at Pine Canyon, California, and bred during January and February, 1883. The position assigned this species is uncertain, and it might easily be placed in either *Holcaspis* or *Callirhytis*.

Genus AMPHIBOLIPS, Rheinhardt.

21. AMPHIBOLIPS TINCTORIÆ, new species.

Gall.—A compressed ovate, brownish gall, the opposite sides of which are keeled: the shell is moderately thick, and internally there is a central kernel held in place by fibrous filaments. Length, 2 cm., diameter less than 1 cm.

Gallfly.—Female. Length, 4.6 to 5 mm. Black, the antennæ and abdomen beneath dark brown, apex of the second segment and apices of the short segments brown; legs reddish yellow.

Antennæ 13-jointed; head rugose; thorax striate-rugose, in one specimen distinctly longitudinally striated; in the other the striæ are often oblique and irregular; parapsidal grooves obliterated by the rugosities, or only slightly indicated anteriorly; scutellum coarsely rugose, with two large deep foveæ at base, separated by a carina. Mesopleura rugose, usually hairy, one specimen with a rased smooth spot. Wings hyaline, veins distinct, dark brown, the areolet large, the cubital cell closed, the vein at base of radial cell angulated and inclosed in a brown blotch.

Type.—3076, U.S.N.M.

Two specimens, reared October 16, 1871. Locality unknown. The Note Book says:

Found in November, 1870, by L. G. Satfer, under *Quercus coccinea* var. *tinctoria*, a curious gall of same structure as 415, but with two carinated sides and with thicker walls.

This species approaches nearest to *A. spongifica*, Osten-Sacken, but the peculiar striated rugose thorax readily distinguishes it from that species and all others in the genus, except the dimorphic form *A. aciculata*, Osten-Sacken.

22. AMPHIBOLIPS TRIZONATA, new species.

Gall.—A large, globular gall, from an inch to an inch and a quarter in diameter, externally resembling *A. coccinea*, Osten-Sacken, but internally of a white, pithy, cellular structure.

Gallfly.—Male and female. Length, 5 to 6 mm. Entirely black, antennæ, face, tibiæ, and tarsi dark brown; ocelli red.

Head and thorax coarsely rugose. Antennæ, in female, short, 13-ointed; in male, longer, 15-jointed. Eyes prominent. Parapsidal grooves entirely wanting, except the two short anterior median grooves and the groove on the shoulders. Scutellum very coarsely rugose, the foveæ at base large, distinct, and confluent, separated only by a slight carina. Abdomen globose, polished, the apical portion of the second and following segments finely punctate.

Wings hyaline, with three transverse, smoky bands, the one at the base not as distinct as the one across the middle and the one at the

apex of the wing; veins piceous, the areolet wanting, the cubital cell closed.

Type.—No. 3077, U.S.N.M.

Five specimens, reared during June, 1882, from galls received May 2, 1882, from Mr. H. K. Morrison, collected at Fort Grant, Arizona. The gall is said to grow on the blossoms of an oak.

23. AMPHIBOLIPS ACUMINATA, new species.

Gall.—The mature specimens of this species average considerably over 2 inches long by more than an inch in diameter; they are brownish yellow, subglobular, and acuminated at apex, constructed on the same principle as most of the apple galls, having a central kernel, held in place by a spongy substance, and a very thin shell. Some specimens are much more acuminated than others and what may be termed pepper-shaped, not more than half an inch in diameter and much less than 2 inches in length. The gall is attached to the twigs.

Gallfly.—Female. Length, 5 mm. In stature and color this species approaches nearest to *A. spongifica*, Osten-Sacken, but the sculpture is more coarsely rugose, the parapsidal grooves distinct, while the hind legs are black.

Type.—No. 3078, U.S.N.M.

One female specimen, reared June 24, 1879. The gall occurs in Washington on *Quercus niger*. The specimen from which the fly was reared was taken by Dr. L. O. Howard in Maryland.

Genus HOLCASPIS, Mayr.

24. HOLCASPIS PERSIMILIS, new species.

Gall.—A small, hard, globular gall, occurring on the twigs of the black oak and very similar in structure to other Holcaspid galls. It is, however, smaller, less than 7 mm. in diameter, and exteriorly it is very rough or rugose, with irregular raised lines and ridges.

Gallfly.—Female. Length, 4 mm. Head, antennæ, thorax, and legs brown, covered with fulvous pile. Vertex of head and streaks on thorax black. Antennæ 13-jointed, rather long. Head and thorax punctate; the parapsidal grooves are obsolete anteriorly; anteriorly are two short median grooves, extending posteriorly to more than half the length of the mesonotum, while the groove on the shoulders is long. Mesopleura punctate, the sculpture hidden by the pubescence. Abdomen black, the sides of the large second segment pubescent; apices of the short terminal segments dull rufous. The spine of the ventral valve is as long as the second posterior tarsal joint and very hairy.

Wings hyaline, veins piceo-black, the areolet distinct, but the surrounding veins—except the outer vein, which is thick and angulated—delicate; cubital cell open at base; the vein at base of radial cell angulated.

Type.—No. 3079, U.S.N.M.

Described from a single specimen, labeled simply: "Black-jack oak, issued November 10, 1868."

The angulated outer vein of the areolet in this species at once separates it from all the others.

25. HOLCASPIS TRUCKEENSIS, new species.

Gall.—An irregular, inflated, hard, woody gall, over an inch long and about half an inch in diameter, issuing from a slit in a terminal twig of *Quercus chrysolepis* var. *vaccinifolia;* polythalamous.

Gallfly.—Female. Length, 3.4 mm. This species in color and size closely resembles *H. ficigera*, Ashmead, but differs as follows: The 14-jointed antennæ, except the first two joints, pleura, and metathorax blackish, shining; the rest of the insect—except the dorsum of the second abdominal segment, which is obfuscated—brownish yellow; the head and thorax punctate, and covered with a glittering white pubescence. Abdomen highly polished, bare, except the sides of second segment basally; spine of ventral valve short, stout, hairy. Wings hyaline, veins brown, areolet distinct, cubital cell open at base, while the basal vein of radial cell is only obtusely angular.

Type.—No. 3080, U.S.N.M.

Two specimens, reared December 6, 1880, from galls collected by Prof. J. H. Comstock, in California, October 16, 1880.

26. HOLCASPIS DOUGLASII, new species.

Gall.—The construction of this gall is on the same principle as the other Holcaspian galls, but instead of being globular it resembles a diminutive squash, the ridges surrounding the margin being prolonged into irregular tubercles, usually from 7 to 10 in number.

Gallfly.—Female. Length, 2.6 to 3 mm. Reddish brown, pubescent, the anterior short median grooves of mesonotum and the groove on the shoulders being on a black surface. Antennæ 14-jointed, slightly, gradually incrassated toward tips and apically dusky.

Head and thorax punctate; parapsidal grooves delicate, but distinct throughout; two short median grooves anteriorly and a groove on the shoulders distinct; foveæ at base of scutellum confluent, not separated by a carina; pleura shining, but punctate.

Wings hyaline, pubescent, the veins blackish, the radius slightly incrassated at tip, and the vein at base of radial cell angulated. There is a discolored streak below the areolet, and a large brownish mark below the middle of the radius in the apical cell.

In some specimens the tibiæ and tarsi are dark brown and two specimens have the abdomen nearly black.

Type.—No. 3081, U.S.N.M.

Seven specimens, received from Mr. Albert Koebele, collected in Marin County, California, and reared December 19, 21, 24, 1895. The gall occurs on the lower side on the leaves of *Q. douglasii.*

Genus BASSETTIA, Ashmead.

27. BASSETTIA GEMMÆ, new species.

Female.—Length, 1.8 to 2 mm. Black; antennæ and legs—except coxæ and femora—reddish brown; coxæ and femora black. Head rounded in front, antero-posteriorly thick, broader than the thorax, and closely, finely punctate. Thorax strongly, transversely rugulose, the parapsidal grooves obliterated, two short, glabrous, median lines anteriorly, and a glabrous line on the shoulders. The mesonotum and the scutellum are hardly separable, being almost connately joined, and presenting an almost unbroken surface. The mesopleura are smooth and polished posteriorly, but anteriorly they are closely punctate.

The abdomen is much compressed, as deep ventrally as long. The ventral spine is as long as the second joint of the posterior tarsi, while the sheaths of the ovipositor project.

Type.—No. 3082, U.S.N.M.

Described from three female specimens, labeled "From J. G. Barlow, Cadet, Mo., April 27, 1880, ovipositing in buds."

28. BASSETTIA PALLIDA, new species.

Female.—Length, 2 mm. Head, the 13-jointed antennæ, thorax, and legs, brownish yellow; the eyes and posterior tibiæ dark brown, abdomen polished black. In shape it bears a close resemblance to the one just described, but besides the colorational differences the sculpture of thorax is less coarsely rugulose, and the ovipositor sheaths do not project, while there is a transverse grooved line at base of scutellum.

Type.—No. 3083, U.S.N.M.

Described from a single specimen labeled "Savannah, Georgia, April 15, 1884."

COMPSODRYOXENUS, new genus.

This genus is similar to *Bassettia*, but differs in having filiform, 13 or 14 jointed antennæ, the third, fourth, fifth, and sixth joints being of nearly an equal length, those beyond gradually shortening.

The head and thorax are closely, confluently punctate, or slightly rugose; thorax narrowed, the parapsidal grooves delicate but distinct; scutellum rugose, cushion-shaped, separated from the mesonotum by a transverse groove; pleura punctate. Abdomen compressed and shaped as in *Bassettia*, the ventral valve very prominent, pointed plowshare-shaped.

The wings, unlike *Bassettia*, have a distinct areolet, the vein at base of marginal or radial cell arcuate and surrounded by a brown spot or cloud, as in the genus *Amphibolips;* the margins of the basal vein are also clouded, while there is a brown spot before the break in the anal nervure. Claws entire.

29. COMPSODRYOXENUS MACULIPENNIS, new species.

Gall.—The gall produced by this species, and from which the flies were reared, is confused in the collection with *Andricus coxii*, Bassett, and the resemblance between them is so close that I am unable to separate one from the other, although it is possible there may exist some difference.

Gallfly.—Female. Length, 2.6 to 4 mm. Head, thorax, and middle tibiæ and posterior femora and tibiæ brown; cheeks, antennæ, and legs, with the above exceptions, pale yellowish brown.

Antennæ 14-jointed, reaching to base of abdomen. Thorax slightly transversely rugulose, the parapsidal grooves entire, the groove on the scapulæ distinct. Wings hyaline, veins brown, the margins of basal vein, a spot before the break in the anal vein, and a large blotch at base of marginal cell, including its basal nervure, brown; other characters as described in the generic description.

Type.—No. 3084, U.S.N.M.

All females, which issued from the galls May 9 to 19, 1883. The galls were taken on a live oak in Arizona by H. K. Morrison.

30. COMPSODRYOXENUS BRUNNEUS, new species.

Gall.—The gall of this species was likewise confused in the collection with a similar gall (*Andricus chrysolepidis*), occurring on *Q. chrysolepis* in California, but I can distinguish two kinds of galls, although both bear the same number (2972). Both are very much alike externally, but one is polythalamous, the other monothalamous, and I believe the latter is the one producing the present gallfly.

Gallfly.—Female. Length, 2 to 2.6 mm. Head, antennæ, thorax, and legs pale or light brown, the antennæ toward tips dusky, the pleura blackish, the abdomen black, polished, the posterior legs dusky or darker than the others. Wings hyaline, marked as in previous species.

The species is closely allied to the preceding, but it is smaller, paler colored, and has but thirteen joints in the antennæ.

Type.—No. 3085, U.S.N.M.

Specimens reared June 9, 1883. Under this number the Record Book contains the following:

January 13, 1893.—Received to-day from Mr. H. W. Turner, of Martinez, California, a lot of elongate, oval twig-galls, found on scrub-oak; some of them were collected January 3 in Pine Canyon, Mount Diablo, Contra Costa County, and some from apparently the same species of oak at Martinez; placed galls from different localities into different bottles to breed.

Genus TRISOLENIA, Ashmead.

31. TRISOLENIA PUNCTATA, new species.

Female.—Length, 5.2 mm. This species in general appearance closely resembles *T. saltata*, but the abdomen is darker, being reddish piceous, more globose, and distinctly finely punctate, the second segment only

half the length of the abdomen (in *T. saltata* it is two-thirds as long); while the antennæ are but 15-jointed, the third joint being not quite twice as long as the fourth. Pleura aciculated; scutellum coarsely rugose, with two large, deep foveæ at base, separated only by a carina.

Wings hyaline, tinged with yellow, basal nervure of radial cell arcuate, the areolet distinct, cubital cell open at base. Legs dark red, the posterior coxæ dusky or black.

Type.—No. 3086, U.S.N.M.

Described from one specimen, received from Rev. J. L. Zabriskie, Nyack, New York, February 6, 1884. The gall made by the fly is unknown.

Genus CALLIRHYTIS, Förster.

32. CALLIRHYTIS VACCINIIFOLIÆ, new species.

Gall.—A thin-shelled, globular gall, with a central kernel held in place by radiating filaments and closely resembling the gall produced by *A. inanis*, Osten-Sacken, but the average size is smaller and the color of the gall darker. It measures from half an inch to a little over an inch in diameter and is found on *Quercus vaccinifolia* in California.

Gallfly.—Female. Length, 2 to 3.2 mm. Red or brownish red (one specimen has the thorax almost black), antennæ and legs brownish yellow, sometimes obfuscated; several terminal joints of the antennæ are dark brown.

Head closely punctate; thorax almost smooth, the parapsidal grooves sharply defined, complete, a short median groove posteriorly and the groove on the shoulders indistinct; scutellum rugose, the foveæ large, broad, distinct, and separated only by a carina; mesopleura smooth, polished, the triangular piece beneath tegulæ alone being punctate. The abdomen is larger than the head and thorax together, the segments oblique, the second segment occupies about two-thirds of the whole surface and is a little pubescent at sides near the base, impunctate, some of the short terminal segments a little dusky; spine of ventral valve rather long, hairy. Wings hyaline, pubescent, the veins pale brown; the vein at base of marginal cell is slightly bent, but not angulate, the marginal cell being very long and narrow, areolet distinct, but the surrounding veins delicate, cubital cell almost closed.

One of the specimens is but 2 mm. long and of a uniform brownish-yellow color, but structurally it does not seem to differ from the others.

Type.—No. 3087, U.S.N.M.

Four specimens, reared October 16 and December 4, 1884, from galls collected by Prof. J. H. Comstock, at Truckee, California, on *Quercus vacciniifolia*.

33. CALLIRHYTIS CRASSICORNIS, new species.

Gall.—A peculiar, irregular, somewhat triangulated, hard, finely rugose, blackish seed-like gall, issuing from the twig, most of them being covered with a whitish efflorescence.

The gall, structurally, is similar to that produced by *A. conifera*, Ashmead, and the part embedded in the twig is triangularly shaved off to a sharp edge. The fly escapes from its larval cell through a hole perforated in the side.

Gallfly.—Length, 2.8 mm. Head and thorax black, abdomen piceous black, antennæ and legs reddish brown.

The head and thorax are shining, but delicately punctulate, pubescent. Head broad, the cheeks bulging. Antennæ 13-jointed, incrassated toward tips; the first joint is almost as long as the third and stout, the third is about one-third longer than the fourth, the following joints to ninth subequal, the rest of the joints—except the terminal, which is twice as long as thick—are as thick as long. The thorax has two sharply defined parapsidal grooves; the two short median grooves anteriorly and the groove on the shoulders appear merely as glabrous lines.

Scutellum rounded, minutely rugose, the foveæ deep but distant. The abdomen is as long as the head and thorax combined, highly polished, the second segment occupying two-thirds its length and pubescent at sides; the spine of the ventral valve is very long, about as long as the first tarsal joint of posterior legs, and a little hairy. Wings hyaline, pubescent, veins brown, areolet distinct but small, the surrounding veins stout, the vein at base of marginal cell slightly angulate, cubital cell closed, but the cubitus pale at base.

Type.—No. 3088, U.S.N.M.

Four female specimens received through Mr. F. B. Hough, reared October 10, 1884.

34. CALLIRHYTIS FRUCTICOLA, new species.

Gall.—This gall consists simply of the white kernel or larval cell embedded in the interior or meaty portion of the acorn, or then on the outside near its base, generally hidden by the cup.

Two or three acorns in Dr. Riley's collection, affected by this species, when cut open, revealed more than a dozen larval cells, closely pressing upon one another, and filling the whole interior of the acorn.

Gallfly.—Female. Length, 3 to 3.6 mm. Brownish red, the eyes and middle and posterior tibiæ dark brown.

Antennæ 13-jointed, filiform, the scape clavate, as long as the third joint, the fourth joint one-third shorter than the third. Head and thorax closely, minutely, rugosely punctate, subpubescent; the parapsidal grooves distinct, entire; anteriorly are two short grooves reaching to near the middle of the mesonotum, and the groove on the shoulders is long. Foveæ of scutellum large, separated only by a carina. Mesopleura punctate, slightly aciculated posteriorly. Abdomen longer than the head and thorax together, gradually rounded off posteriorly and from below a little obliquely rounded, the second segment occupying two-thirds of its whole length, the sutures running obliquely forward to the venter, ventral valve hidden, the sheaths of ovipositor short but slightly projecting. Wings hyaline, veins pale

brown, the cubitus and radius very slender, pale, the vein at base of marginal cell arcuate, the areolet wanting.

Type.—No. 3089, U.S.N.M.

Six female specimens, reared April 5, 1873.

35. CALLIRHYTIS RHIZOXENUS, new species.

Gall.—A large, irregular, more or less globular, fleshy swelling, occurring on the roots of an oak in Arizona, and containing numerous larval cells; some galls measure about 4 cm. in length; others are much smaller.

Gallfly.—Female. Length, 3 to 3.4 mm. Head and thorax dark brown or blackish, antennæ and legs pale brown, the posterior femora and tibiæ dark brown, or at least obfuscated, abdomen red or brownish red. Head and thorax closely punctate or minutely rugose, subpubescent. Antennæ 14-jointed, filiform. Parapsidal grooves entire, two median lines extending to middle of mesonotum anteriorly, and a very distinct groove on the shoulders. Scutellum rugose, the foveæ confluent. Mesopleura punctate, hairy, with a smooth spot posteriorly and an indented line. Abdomen smooth, polished, about as long as the head and thorax combined, with some hairs at sides of second, third, and fourth segments; the second segment occupies about half the length of the abdomen, and the third and fourth segments about one-half of the remaining portion; the spine of the ventral valve is as long as the first tarsal joint of posterior legs. Wings hyaline, subpubescent, veins brown, the areolet and cubital cell distinct, the basal vein of marginal cell angulated.

Type.—No. 3090, U.S.N.M.

Specimens reared June 24 and 28 and July 6, 1882, from galls received from Mr. H. K. Morrison, collected on roots of a live oak at Fort Grant, Arizona.

36. CALLIRHYTIS LASIUS, new species.

Gall.—A hemispherical, hard gall, occurring on the upper or lower surface of the leaves of *Q. chrysolepis*, and covered with a pale, yellowish wool, more or less ringed with ferruginous, some being entirely rust-red; it is polythalamous and in general appearance not unlike *A flocci*, Walsh, but the larval cells are held closely together, embedded in the hard substance composing the gall. Diameter from 5 to 9 mm.

Gallfly.—Female. Length, 2 to 3.8 mm. Pale brownish yellow, the ocelli, eyes, and usually, but not always, the abdomen dorsally, brown.

Head and thorax minutely, confluently punctate, pubescent. Antennæ 14-jointed, moderately long and slender, the tips dusky and the joints delicately fluted, sparsely covered with white pile; sometimes all but the basal joints are dark brown. The parapsidal grooves are delicate but distinct; there is a delicate median groove and

two short median grooves anteriorly and the usual groove on the shoulders.

Scutellum rounded, punctate, subpubescent, the foveæ small, oblique. Mesopleura closely punctate; metapleura and metanotum densely pubescent. Claws unidentate.

Wings long, hyaline, the veins pale brown, the areolet distinct, the cubital cell open, the vein at base of marginal cell almost straight or but slightly bent.

Type.—No. 3091, U.S.N.M.

Numerous specimens: reared by Mr. Albert Koebele, at Placer County, California, December 19, 1885, from galls on *Quercus chrysolepis;* others reared January 2, 1882, and December, 1885.

Genus AULAX, Hartig.

In this genus I place several gall-makers that agree quite closely with the representatives of the European species of the genus, except that the *marginal cell is distinctly closed.*

37. AULAX MULGEDIICOLA, new species.

Gall.—The gall of this species consists simply of a thin-shelled larval cell, embedded in the pith of a common plant, *Mulgidium acuminatum;* usually there are numerous cells crowded together side by side in the pith, and externally the stem or stalk shows no apparent gall, swelling, or deformation, although occasionally a slight swelling of the stalk occurs.

Gallfly.—Male and female. Length, from 1.4 to 2.6 mm. Head and thorax black, antennæ dark red, the legs, including coxæ, vary from a red to reddish yellow, the abdomen red or sanguineous.

Head and thorax opaque, closely, confluently punctate. Antennæ long, 13-jointed in female (14 in male), the third joint not longer than the fourth, the following joints gradually subequal, the terminal one usually long, sometimes indistinctly divided into two joints; in the male the third joint is slightly excised and shorter than the fourth.

Parapsidal grooves distinct, and between them posteriorly at the base is a very short groove. Mesopleura delicately, longitudinally aciculated. Scutellum rounded, minutely rugose, with two, rather shallow, oblique foveæ at base. Abdomen ovate, polished, the ventral valve and sheaths of ovipositor not projecting, the second segment occupies half its whole surface; the third segment is about half as long as the second, the following segments being very short.

Wings hyaline, pubescent, veins brown, the areolet very small, often entirely wanting, marginal and cubital cells closed.

Type.—No. 3092, U.S.N.M.

Numerous specimens, most of them reared during January and February, 1886, from galls collected in the District of Columbia, labeled No. 3640.

AULAX CAVICOLA, new species.

Female.—Length, 2.4 to 3 mm. This species bears a very close resemblance to *A. mulgediicola*, but differs as follows: The face is without the median ridge; the short median groove of the mesonotum is longer, extending not quite to the middle; there is a distinct groove on the shoulders, extending from the base forward to at least half their length; the second and third abdominal segments dorsally at base are very dark, almost black, making the abdomen appear as if banded, while the basal joint of posterior tarsi is longer than it is in *A. mulgediicola*.

Type.—No. 3093, U.S.N.M.

Described from two female specimens, labeled Indian Cave, Missouri, April 30, 1878.

39. AULAX SONCHICOLA, new species.

Male and female.—Length, 2.2 to 2.6 mm. This species is likewise closely allied to *Aulax mulgediicola*, but the antennæ in both sexes are distinctly 14-jointed, pale brownish yellow, the two basal joints dusky or black, more noticeable in the male, the terminal joint being very much longer than the preceding. The abdomen in female is reddish brown, obfuscated dorsally, in the male blackish; legs brown, with the posterior tibiæ more or less dusky. Thorax subpubescent, and in addition to the parapsidal grooves there are two short indistinct median grooves anteriorly and a distinct median groove posteriorly, the foveæ shallow, small, the mesopleura finely striated.

Wings hyaline, pubescent, the venation as in *A. mulgediicola*.

Type.—No. 3094, U.S.N.M.

Four specimens, reared during June, 1887, from a gall occurring on the stem of a species of wild lettuce, *Sonchus oleraceus*, found at Asheville, North Carolina, by the writer. In my own collection are specimens collected in Canada.

40. AULAX AMBROSIÆCOLA, new species.

Gall.—The insects from which the following description is drawn up were received from Miss Mary Murtfeldt, of Kirkwood, Missouri, with the statement that they were parasitic on a lepidopterous gallmaker, on *Ambrosia*.

Now there is some mistake here; the flies are unquestionably true gallmakers and evidently form larval cells in the pith of this plant, not observed by Miss Murtfeldt; and, moreover, their structural characters prove conclusively that they are not parasitic. It is also quite probable that the Lepidopteron is inquilinous in the galls produced by this species.

Gallfly.—Male and female. Length, 2 to 2.2 mm. In size, structure, and general appearance this species comes remarkably close to *Aulax mulgediicola;* but with a very high power lens the sculpture appears very distinct, the punctuation being slightly transverse. There is a

short acute median groove between the parapsidal grooves posteriorly, the scutellar foveæ are not so sharply defined, while the color of legs and abdomen will at once distinguish it from that species.

In the female the legs and abdomen are reddish yellow, while the abdomen in the male is black.

Habitat.—Kirkwood, Missouri. Miss Mary Murtfeldt.

Type.—No. 3095, U.S.N.M.

Four specimens, 1 female and 3 males, reared October 18, 1881, and June 13, 1882. It is unfortunate that none of the galls were sent with the flies.

Genus DIASTROPHUS, Hartig.

41. DIASTROPHUS SMILACIS, new species.

Gall.—An irregularly rounded, abrupt, smooth swelling, occurring on and usually surrounding the stems of *Smilax rotundifolia* and *S. herbacea*. It is of a pithy structure, and, in general appearance, exactly similar to the rose gall, *Rhodites ignota*, Osten-Sacken, with which it might easily be confounded in a collection.

It is polythalamous, seldom much over an inch in length by from a half to three-quarters of an inch in diameter.

Gallfly.—Female. Length, 2.6 to 3 mm. Polished black, the antennæ dark red, legs yellowish red. The face, collar, and metathorax punctate or rugulose, pubescent. Antennæ 13-jointed, moderately stout and rather short; the third joint is narrowed at base, about one-third longer than the fourth and about as long as the terminal joint, the following joints a little longer than thick, delicately fluted. Thorax and mesopleura smooth, polished, the two parapsidal grooves distinct. Scutellum rugose, a little prolonged at apex and with two broad foveæ at base, separated by a carina. Abdomen short, compressed below, and a little piceous along the venter, the ventral valve without a spine. Wings hyaline, pubescent, veins dark, the margins of the basal vein and the base of marginal cell a little clouded, areolet large, distinct, cubital cell closed; the radial vein at about two-thirds its length is slightly bent and extends along nearly parallel with the open margin of the radial cell.

Type.—No. 3096, U.S.N.M.

Thirteen females, reared during January and February, 1884, from galls received from Mr. J. C. Arthur Chicago, Illinois. The gall has also been taken by Mr. E. A. Schwarz, in Florida.

Genus RHODITES, Hartig.

42. RHODITES GRACILIS, new species.

Gall.—An irregular, inflated, rounded gall, with the top broadened and somewhat flattened, the edges surrounded with short, blunt tubercles, which are probably the apices of elevated ribs.

Gallfly.—Male and female. Length, 2.2 to 3 mm. In the male the two basal antennal joints and legs are red; in the female the whole abdomen is red; rest of the insect black. Head finely, closely punctate, the vertex almost smooth, thorax, scutellum, and pleura rugose, parapsidal grooves distinct posteriorly, somewhat obliterated by the sculpture anteriorly, the middle lobe with a central longitudinal depression. Antennæ 14-jointed, the third joint very long, more than twice as long as the fourth. Wings hyaline, veins brown, the areolet large, cubital cell almost closed; in the female the basal vein of the closed radial cell and the radius is surrounded with a dusky cloud, which is wanting in the male.

Type.—No. 3097, U.S.N.M.

Described from 4 specimens, 1 female, 3 males, reared May 7, 1870. The name of the rose on which it occurs is unknown. Dr. Riley in his Note Book says:

A small gall, bearing a general resemblance to a mangel-wurzel seed or large beet seed, occurring on rose trees, and especially on the single wild rose. The galls were first noticed in September.

43. RHODITES SIMILIS, new species.

Gall.—An irregularly rounded, brown or brownish yellow, pithy gall on the smaller stems of an unknown wild rose. They vary greatly in size and shape, from a small pea-like form to a more or less globular or oblong shape, some of them being an inch or more in length. There is no consistency in their shape; some are perfectly round or oblong or of various irregular shapes.

Gallfly.—Female. In stature and color, this species is very near *R. dichlocerus*, Harris, but the surface of the thorax is much smoother, shining, the head and lateral lobes of mesothorax are darker, almost black, the median and parapsidal grooves more distinct, broader, the disk of the mesopleura smoother, veins darker, while the vein at base of marginal cell is arcuate.

The male is entirely black, except the basal antennal joints, spots on vertex above base of antennæ, and the legs, which are red, the middle and posterior coxæ being black basally.

It may be distinguished at once from the male of *dichlocerus* by its much larger size, broad parapsidal grooves, the smooth shining spot on mesopleura, and the red basal joints of the antennæ.

Type.—No. 3098, U.S.N.M.

Twenty-seven specimens, reared July 27, 1883, from galls collected by Mr. Lawrence Bruner at Point of Rocks, Wyoming.

Two different galls bearing same number are here confused, one being *R. variabilis*, Bassett, the other *R. similis*, Ashmead.

PRELIMINARY DIAGNOSES OF NEW MAMMALS FROM THE MEXICAN BORDER OF THE UNITED STATES.

By EDGAR A. MEARNS, M. D.,
Assistant Surgeon, United States Army.

THIS is the fourth of a series of papers giving preliminary descriptions of the new mammals collected on the recent survey of the Mexican boundary.[1]

In explanation of the meaning of the term *Tract* as used in these papers, it should be stated that it has been found necessary, for the purposes of the report on the Mexican boundary collections, to divide the boundary strip geographically as well as faunally. *Faunally*, this line across the continent gives a section through the several altudinal zones from the Tropical to the Boreal, though almost all of it lies within the Sonoran or Austral. *Geographically*, I have subdivided it into (1) five principal tracts, and (2) others which are subsidiary—prolongations or irregular extensions of areas which are not fairly bisected by the Mexican boundary line; and to these we may as well add the insular tracts at either extremity of the boundary parallel. These tracts might well be styled "mammal variation tracts," for they are based solely on the geographical variation of mammals, though geologists inform me that they mark very distinct geographic if not geologic regions. Briefly, these geographical subdivisions of the boundary line are as follows:

A. PRINCIPAL TRACTS.

1. Comanche or Middle Texas Tract.
2. Chihuahua or Eastern Desert Tract.
3. Apache or Elevated Central Tract.
4. Yuma or Western Desert Tract.
5. San Diego or Pacific Coast Tract.

B. MINOR TRACTS.

1. Tamaulipan Tropical Tract (=Rio Grande Embayment).
2. Sierra Madré Tract.
3. Yaqui Basin Tract.
4. Lower Californian Tropical or Palm Tract.

C. INSULAR TRACTS.

1. Padré Island Tract (Gulf of Mexico).
2. Santa Barbara Island Tract (Pacific Ocean).

[1]See Proc. U. S. Nat. Mus., XVII, pp. 129–130; XVIII, pp. 443–447; XVIII, No. 1081.
[Advance sheets of this paper were published May 25, 1896.

NOTE.—The advance sheets of this paper were issued as belonging to Vol. XVIII, 1895, but it was found impossible to include it in that volume, and hence its insertion at this place.—EDITOR.]

PEROMYSCUS MERRIAMI, new species.

SONOYTA DESERT MOUSE.

Type.—No. 59234, U.S.N.M., skin and skull (Coll. International Boundary Commission). Adult female, from the village of Sonoyta, on the Sonoyta River, Sonora, Mexico. Collected by Edgar A. Mearns and F. X. Holzner, January 21, 1894. Original number, 2815.

Description of type.—Very similar in appearance to *Peromyscus eremicus*, with which it agrees in having the soles of the feet entirely bare, the ears nearly naked, and the tail long, tapering, and scantily haired, without a terminal pencil. In coloration the two are identical except that the light cinnamon extends down the outer side of the fore limbs to the hand; and there is a large pectoral patch of cinnamon. Length, 217 mm.; tail vertebræ, 113; ear from crown, 20; length of hind foot and claw, 23. Body stout and heavy as compared with *P. eremicus*. The skull most resembles that of *P. eremicus*. It has the same posteriorly truncate nasals and general conformation, but differs notably in having the rostral portion relatively longer, the zygomatic arches wider anteriorly, and the brain-case more highly arched. Its larger size serves to identify the skull of this species at a glance, the two anterior molar teeth about equaling the lateral tooth-row of *P. eremicus*. *Peromyscus merriami* and *P. eremicus* occur together at Sonoyta and Quitovaquito, on the Mexican line.

PEROMYSCUS EREMICUS ARENARIUS, new subspecies.

EASTERN DESERT MOUSE.

Type.—No. $\frac{20018}{35418}$, U.S.N.M. (Coll. International Boundary Commission). Adult male, from the Rio Grande, about six miles from El Paso, Texas. Collected by Edgar A. Mearns and F. X. Holzner, February 25, 1892. Original number, 1513.

Description of type.—Above pale ochraceous drab finely mixed with black, without a darker median area; sides and rump pale ochraceous buff; ears almost naked, but with a scant pubescence on the margin and anterior band; tail, dusky drab above, mixed with hoary, pure white below; under parts and feet pure white. The head is somewhat grayish, and there is a dusky orbital ring. The outer border of the first and second upper molars have but three salient and two re-entrant loops or enamel folds, as is usual in the group of desert mice. Length, 198 mm.; tail vertebræ, 106 (to end of hairs, 111); ear, from crown, 15 (from notch, 18); distance between eyes, 9; diameter of eye, 4; length of longest whisker, 42; distance from tip of nose to eye, 13.5; to center of pupil, 16; to ear, 23; to tip of ear, 44; to occiput, 29; to end of outstretched hinder extremity, 138; fore limb, from olecranon process to end of longest claw, 25; length of fore foot, 12; longest claw of fore foot, 1.8; hind limb, from knee-joint to end of longest claw, 42; length of hind foot, 21.5, longest claw of hind foot, 1.8. Skull, 25 by 12.7 mm.

PEROMYSCUS BOYLII PENICILLATUS, new subspecies.

BAREFOOTED BRUSH MOUSE.

Type.—No. $\frac{20034}{35426}$, U.S.N.M. (Coll. International Boundary Commission). Adult female, from the foothills of the Franklin Mountains, near El Paso, Texas. Collected by Edgar A. Mearns and F. X. Holzner, February 19, 1892. Original number, 1463.

Description of type.—Above drab-gray, tinged with ochraceous buff on sides and rump. Ears nearly naked, with a scant hoary pubescence. Tail dusky drab above, pure white below, penicillate, and rather hairy throughout. Feet and under parts pure white. Length, 202 mm.; tail vertebræ, 115; ear from crown, 14 (from orifice, 18); distance between eyes, 12; diameter of eye, 4; length of longest whisker, 47; from tip of nose to eye, 16; to center of pupil, 19.5; to ear, 28; to end of outstretched hind limb, 143; to occiput, 31; fore limb, measured from olecranon process to end of claws, 24; length of manus, 11; longest claw of manus, 2; hind limb, measured from knee-joint to end of claws, 45; length of hind foot with claw, 22; longest claw of hind foot, 2.5. Skull, 28 by 14 mm.

Cranial and dental characters.—The skull is elongated, with the lengthened and depressed rostrum of *P. boylii* and *P. boylii pinalis*, but differs from them in having the nasal bones truncate posteriorly and ending considerably in front of the posterior extremities of the nasal branches of the premaxillaries, instead of terminating in a point well behind them. The dentition is very different from that of the *eremicus* group, and agrees with the members of the *P. leucopus* group in having a subsidiary loop or fold of enamel between the two principal loops at the outer side of the first and second upper molars.

The species to which this Brush Mouse belongs (*Peromyscus boylii*, Baird) is evidently the connectant between the wood mice (*P. leucopus* group) of the East and the desert mice (*P. eremicus* group) of the West. The subspecies *penicillatus* has the tail as long and soles as bare as those of *P. eremicus arenarius* of the same region; its coloration is almost identical; and it has the same posteriorly-truncate nasals and large, nearly naked ears. It agrees with *P. leucopus* in having a hairy tail and the more complicated enamel folds in the first and second upper molar teeth described above. The western forms of the Brush Mouse (*P. boylii*, *P. b. rowleyi*, and *P. b. pinalis*) have pointed nasals—much as in *Onychomys*—and hairy heels.

ONYCHOMYS TORRIDUS ARENICOLA, new subspecies.

EL PASO GRASSHOPPER MOUSE.

Type.—No. $\frac{20085}{35433}$, U.S.N.M. (Coll. International Boundary Commission). Adult male, from the Rio Grande, about six miles above the town of El Paso, Texas. Collected by Edgar A. Mearns and F. X. Holzner, February 29, 1892. Original number, 1528.

Description of type.—Similar to *Onychomys torridus*, but slightly smaller, with relatively smaller ears, and a very much paler coloration.

Above drab-gray, inclining to fawn color on sides; dorsal area with very little admixture of black-ringed or black-tipped hairs; with a conspicuous tuft of white hairs at anterior base of ear; dark spot on anterior band of ear, drab (not black); whiskers more white than black; under parts, feet, and end of tail, white; basal two-thirds of upper side of tail, drab, some of the hairs with hoary tips. Length, 137 mm.; tail vertebræ, 53 (to end of pencil, 57); ear from crown, 14; ear from notch, 17; distance between eyes, 10; diameter of eye, 4; longest whisker, 38; from tip of nose to eye, 13; to center of pupil, 15; to ear, 21.5; to tip of ear, 40; to occiput, 29; to end of outstretched hinder extremity, 133; fore limb, measured from olecranon process to end of longest claw, 28; length of fore foot, 13.4; longest claw of fore foot (chord), 3; hind limb, measured from knee-joint to end of longest claw, 41; length of hind foot, 21; longest claw of hind foot, 2.7. Skull, 25.5 by 13.5 mm.

Geographic range.—This is the counterpart and miniature of *Onychomys pallescens*, Merriam. The two are almost indistinguishable in color; and their ranges are probably coincident. We found it only on the Rio Grande near El Paso; but there is a specimen in the United States National Museum (No. $\frac{1582}{448}$), formerly included by Secretary Baird in his "list of specimens" of "*Hesperomys texanus*," which was collected by Dr. Kennerly, between the Pecos River and the Rio Grande. The specimens of this species of *Onychomys*, taken by us west of the Rio Grande, for the first hundred miles, are small-eared, but otherwise closely resemble typical *torridus*, to which subspecies they are unhesitatingly referred.

ONYCHOMYS TORRIDUS PERPALLIDUS, new subspecies.

YUMA GRASSHOPPER MOUSE.

Type.—No. 60174, U.S.N.M. (Coll. International Boundary Commission). Skin and skull. Adult female, from the left bank of the Colorado River, at Monument No. 204, Mexican boundary line. Collected by Edgar A. Mearns and F. X. Holzner, March 27, 1894. Original number, 3301. (Has suckled young.)

Description of type.—Larger than *Onychomys torridus* (typica), with relatively larger ears, longer tail, and a much paler coloration. Color above, drab-gray, becoming more cinereous anteriorly; sides and rump barely tinged with fawn color; dusky line on basal three-fourths of tail much obscured by whitish hairs—nearly obsolete; ears less densely clothed than in the remaining forms of *Onychomys torridus*, and without a well-defined, dusky spot; whiskers mostly white or colorless; under parts, feet, and end of tail, white. Length, 157 mm.; tail vertebræ, 57; ear from crown, 16; length of hind foot, 22. Skull, 26 by 13.7 mm.

Geographic range.—This subspecies was first found on the lower Gila River, at Gila City, on the east side of the Yuma Desert. Its range extends thence westward across the Yuma and Colorado deserts to the Coast Range of mountains. In the direction of the San Bernardino Valley, of California, it intergrades with the dark-colored Pacific Coast form which Mr. Rhoads has named *ramona*.

DESCRIPTION OF A NEW GENUS AND FOUR NEW SPECIES OF CRABS FROM THE WEST INDIES.

By MARY J. RATHBUN,
Second Assistant Curator, Department of Marine Invertebrates.

THE SPECIES here described are represented in the collection of Mr. P. W. Jarvis, Kingston, Jamaica, and the descriptions will be reprinted in a list of Jamaica crabs shortly to be published in the Journal of the Institute of Jamaica. The types are in the United States National Museum.

EUCINETOPS BLAKIANA, new species.

Closely allied to *E. lucasii*, Stimpson, from the Pacific Coast. Carapace oblong, antero-lateral margins slightly converging anteriorly, nearly straight; postero-lateral margins more oblique than in *E. lucasii*.

Surface uneven; median regions elevated, hepatic region depressed, separated from the branchial by a deep hollow and a marginal sinus. Antero-lateral margin tuberculate, a spine at the postero lateral angle; a few additional tubercles on the upper surface of the branchial region.

Front depressed; rostrum shorter than in *E. lucasii*, formed by two rounded lobes, each tipped with a small sharp spine, and separated by a V-shaped sinus. Antero-lateral tooth longer than broad, acute, upturned, separated from the orbit by a narrow rounded sinus. Eye-stalks filling the orbit, tapering to near the cornea; tip slightly enlarged. Abdomen composed of 7 segments in both sexes; in the male, constricted at the fifth segment, sixth segment with convex lateral outlines; seventh rounded, broader than long. Antero-external lobe of the first movable joint of the antennæ moderately developed, not reaching the end of the rostrum.

Chelipeds small, smooth, and shining; merus subtrigonal; carpus with a tubercle above, near the merus; hands compressed, margins converging toward the fingers. Ambulatory legs subcylindrical; dactyli very slender and much curved. Both carapace and ambulatory legs are clothed with hair, and when collected were concealed by bryozoans, grains of sand, and other foreign substances.

Length of female, 6.4 mm.; width, 4.6. Length of male, 4.5 mm.; width, 3.3.

Type locality.—Port Royal, Jamaica (No. 19405, U.S.N.M.).

Named in honor of Lady Blake, wife of the governor of Jamaica, who has done much to promote scientific research on the island.

I do not find in *E. blakiana* those differences in the sexes which are described by Stimpson as occurring in the specimens referred to *E. lucasii*, and it is probable that he had two species before him.

PILUMNUS PANNOSUS, new species.

Pilumnus gemmatus, A. MILNE-EDWARDS, Crust. Rég. Mex., 290, pl. LI, fig. 4, 1880. Not *P. gemmatus*, Stimpson, 1860.

This species resembles *P. gemmatus*, Stimpson, but can readily be distinguished. Carapace less quadrate than in *P. gemmatus*, entirely covered with a soft, thick pubescence, which, however, is not evenly distributed. Here and there, in addition, are longer, irregular club-shaped setæ, which give the crab a very ragged appearance. Frontal lobes subtriangular, granulate on the margin, more advanced near the median line; interspace V-shaped. The antero-lateral projections look like shallow lobes until the pubescence is removed, when they are seen to be triangular, well-separated spines with slender tips pointing forward. In *P. gemmatus* the lateral spines or teeth are shorter, stouter, and less divergent. Upper margin of the orbit with two tuberculiform spines near the inner angle and two between those and the outer angle; lower margin with a row of short, stout, blunt spines of unequal size, and a V-shaped notch next the outer angle.

The upper portion of the hands is tuberculate, but the greater part of the outer surface is smooth and naked. The smaller hand is almost entirely covered with tubercles and granules, but its lower distal portion is bare. In *P. gemmatus* the outer surface of both hands is entirely tuberculate, the tubercles becoming smaller near the lower margin. In *P. pannosus* the pollex is smooth, and there are but a few tubercles on the dactylus near its articulation. In *P. gemmatus* the tubercles extend halfway down the upper surface of the dactylus, and there are a few on the outer surface of the pollex. Both fingers are very deeply grooved in *P. gemmatus;* in *P. pannosus* the grooves are very shallow, and in the larger cheliped consist of series of shallow punctæ. The outer lower margin of the merus in *P. gemmatus* is marked by a broad band of tubercles; in *P. pannosus* this margin is smooth for its proximal half. Ambulatory legs pubescent and bordered with fringes of club-shaped setæ mixed with long fine hairs. Both carapace and legs have the bead-like tubercles of *P. gemmatus*.

Length of male, 8.6 mm.; width, 12.

Type locality.—Key West, Florida; collector, Henry Hemphill (No. 13814, U.S.N.M.).

Range.—Gulf of Mexico and Florida Keys to Jamaica, where it was taken in Kingston Harbor by Mr. P. W. Jarvis. A much more abundant species than *P. gemmatus*.

SESARMA BROMELIARUM, new species.

Length and posterior width of carapace nearly equal, in large specimens exceeding the anterior width; in medium-sized specimens about the same as the anterior width. Regions strongly marked. Surface punctate, the punctæ irregular and having a tendency to coalesce, making the surface rough and uneven. Anteriorly the surface is very rough with squamose tubercles. Branchial striæ well marked. Front about four times as wide as its greatest height. Superior lobes very prominent and separated by deep grooves. Lower margin strongly produced in old specimens; median sinus viewed from above, broad, deep, and rounded; on either side a very shallow sinus. Viewed from in front also, the margin appears sinuous. The third segment of the abdomen of the male has oblique margins, the abdomen being widest at the distal end of that segment. The sixth segment is proportionally longer than in *S. cinerea* and *S. ricordi*, and the last segment more oblong. The appendages are two-lobed at the extremity, the inner less advanced than the outer.

Outer surface of merus and carpus of chelipeds coarsely rugose; the manus is densely tuberculate on the outer side and has large scattered tubercles on the inner side.

Fingers tuberculate to near the extremity. Meri of ambulatory legs less than three times as long as broad, their transverse rugæ much more prominent than in *S. cinerea*. The propodi are fringed above and below with stout black bristles. This character is less marked in small specimens.

Dimensions of Sesarma bromeliarum.

	Rio Cobre		Haiti.
	Male.	Female.	Male.
	mm.	*mm.*	*mm.*
Length, from margin of superior frontal lobes	26.1	24.8	15.0
Anterior width	24.5	23.2	15.0
Posterior width	26.2	25.0	15.2
Superior frontal width	13.7	12.8	8.1
Inferior frontal width	13.4	13.6	8.3
Depth of front	3.3	3.2	2.2
Length of merus of third ambulatory leg	19.8	18.7	11.3
Width of same	7.0	6.6	4.6

Type locality.—Rio Cobre (St. Catherine), Jamaica; P. W. Jarvis (No. 19406, U.S.N.M.).

Range.—Haiti; Jamaica.

Of this crab, Dr. E. A. Andrews[1] says:

A peculiar sesarma-like crab is found in the fresh water rills running into the Wag Water River, at least 12 miles from the sea, and was also taken near the Moneague, on trees, where it lives amid the moist bases of the leaves of bromelias.

[1] Johns Hopkins Univ. Cir., XI, No. 97, p. 75, April, 1892.

METOPAULIAS, new genus.[1]

A grapsoid crab belonging to that section of the family Grapsidæ in which the maxillipeds are crossed by an oblique ridge. Carapace flat, sides arcuate, unidentate. Front less than half the width of the carapace, abruptly deflexed, concave, margins acutely lobate. Antennæ not excluded from the orbit. Merus of external maxillipeds very broad and rounded anteriorly, with an oblique piliferous ridge. Ambulatory legs long and slender. Allied to *Sesarma*.

METOPAULIAS DEPRESSUS, new species.

Carapace subquadrate, entirely flat except close to the margins, sides arcuate anteriorly. Surface punctate, slightly roughened anteriorly. Mesogastric and cardiac regions marked by deep sulci. Branchial and hepatic regions separated only by shallow pits. Front deeply concave both longitudinally and transversely, longer inwardly than outwardly; superior margin with 4 lobes having a sharp granulated edge and one or more granulated ridges across their upper surface. Lobes separated by U-shaped sinuses, the median sinus twice as wide and more than twice as deep as the lateral. Margin of lobes oblique, the inner pair most advanced inwardly, the outer pair most advanced outwardly, or next the orbit. Lower margin of front with two prominent subtruncate lobes separated by a shallow sinus. Outer orbital tooth rather slender, acute. Tooth of lateral margin small, obtuse. Outer maxillipeds widely gaping; merus shorter than the ischium, nearly as broad as long, extremity broadly rounded, scarcely emarginate for the insertion of the palpus.

Chelipeds in the female rather short and rough; merus and carpus with transverse granulated rugæ; outer margin of the lower surface of the merus spinulous; inner border laminate and irregularly dentate. Hands tuberculate outside and in, the tubercles having a tendency to form rugose lines. Fingers punctate, the dactylus tuberculate on its upper surface for its proximal half. Fingers in female not gaping. Ambulatory legs with upper margin of meral and carpal joints minutely spinulous; both margins of propodi and dactyli with larger spinules.

Length, from inner lobes of front, 18.5 mm.; greatest width, 19.8; anterior width, 17.

Type locality.—Newport Manchester, Jamaica (No. 19407, U.S.N.M.). Young specimens were taken at Accompong.

[1] From μέτωπον, front, and αὐλός, groove.

A REVISION OF THE ADULT TAPEWORMS OF HARES AND RABBITS.[1]

By CH. WARDELL STILES, Ph. D.,
Honorary Custodian of the Helminthological Collection, U. S. National Museum.

A DISCOVERY by Cooper Curtice in 1887 regarding certain young stages of rabbit tapeworms, observations which I was able to confirm and extend in 1894, immediately brought the leporine cestodes into a very important position, viewed from an economic as well as from a scientific standpoint, for Curtice's observation at first sight seemed to offer a guide to solving the puzzle as to the larval stage of the tapeworms of cattle, sheep, horses, and certain other animals.

Curtice observed in the intestine of rabbits certain young cestodes which bore minute hooks upon the rostellum, and older stages were found which had lost these hooks. He determined the adult cestodes found in these rabbits as *Tænia pectinata* and looked upon the armed forms as the young of this species.

With these observations before us, it looked as if some very radical changes would be made in the near future in the classification of the tapeworms of the larger domesticated animals; it further seemed probable that the young stage of the tapeworms of cattle, sheep, and horses, would eventually be found to be an armed cysticercoid.

In a paper[2] in 1894 I called attention to this bearing of the question and extended Curtice's observations. I found that the suckers[3] as well as the rostellum were armed, and that the head bore a remarkable resemblance to the head of *Davainea*. This complicated the question in so far as to render necessary the consideration of two further possibilities—i. e., were these young cestodes the early stages of avian

[1] At the request of the author, it is here stated that he is not responsible for the insertion of commas between the names and the authorities, and for the absence of capitals at the beginning of specific names derived from personal names. These changes have been made in order to bring his paper into conformity with the usages at present followed in the U. S. National Museum.—EDITOR.

[2] Notes sur les Parasites—31: Une phase précoce des Ténias du Lapin (Notice préliminaire), Bull. Soc. zool. France, 1894, XIX, pp. 163–165.

[3] Some old sketches of Curtice's show that he also observed the hooks upon the suckers.

cestodes which had accidentally gained access to rabbits, or did there exist in American rabbits an adult cestode belonging to the genus *Davainea*?

The relation of the subject to the tapeworms of cattle, sheep, and horses made it absolutely necessary from an economic standpoint, and the relation of these forms to the adults in rabbits made it desirable from a scientific standpoint, to immediately revise the adult cestodes found in rabbits. This work was accordingly begun, and in 1895 my paper[1] was published announcing the finding of a double-pored cestode with occasional single pores, and the occurrence in American rabbits of a single-pored cestode with a *Davainea*-like uterus.

This paper practically disposed of the young armed cestode of rabbits, for after reading it the natural conclusion of every helminthologist would be that this parasite was probably a *Davainea* and that we were no nearer the solution of the question as to the young form of *Moniezia* than we were before.

The present paper is the result of the revisional study mentioned above. In it I finally dispose of the armed form mentioned in 1894, and at the same time I am obliged to complicate the question as to the larval stage of *Moniezia* still further by presenting an unarmed young cestode in rabbits. I further give an anatomical systematic revision of the adult leporine tapeworms, together with their generic relationship to the cestodes of cattle, sheep, and horses.

I desire to call particular attention to the young unarmed cestode described on p. 201. Had any worker found this parasite in an insect, worm, or snail in a locality where cattle and sheep are infested with *Moniezia expansa*, he would hardly have hesitated to announce the discovery of the intermediate host of this important parasite. The finding in one host of a larval form whose head resembles a certain adult in another host does not, however, scientifically establish the life history of that particular parasite.

I can now prophesy confidently that it will be almost, if not entirely, impossible to distinguish the larval stage of *M. expansa* from that of a dozen or so of other tapeworms, and on account of the great economic importance of this question I caution against any too early and too ungrounded announcement of the source of infection of cattle and sheep by this species. The only work upon this subject which will be worthy of full credence is experimental feeding.

Within recent years it has been customary to associate the larvæ found parasitic in some animals with the adults parasitic in other hosts simply because of a similarity of the heads and hooks. This is particularly the case with the avian tapeworms. I feel it necessary to enter a protest against carrying these generalizations too far, for at present, when so many of the adult avian parasites are so incompletely described

[1] Notes on Parasites—36: A double-pored cestode, with occasional single pores, Centralbl. f. Bakter. u. Parasitenk. 1 Abt., XVII, 13–14, pp. 457–459.

that they can scarcely be recognized, it can hardly be expected that the larvæ can be determined with certainty. The work by Mrázek, Moniez, Hamann, von Linstow, and others in describing these larval forms has been most valuable; but authors have, I believe, generalized too much upon these observations.[1]

Acknowledgments.—I am indebted to the following gentlemen for furnishing me with specimens for study in preparing this revision:

Prof. Raphael Blanchard, of Paris: A portion of Baird's type of *Tænia goezei;* specimens of *Anoplocephala wimerosa* and *Cittotænia leuckarti.* Dr. Gustav Brandes, of Halle: Original cotypes of Riehm's *Dipylidium pectinatum, D. leuckarti,* and *D. latissimum.* Geheimrath Karl Möbius and Dr. A. Collin, of Berlin: Fragment of Rudolphi's *Tænia pectinata.* Prof. Herbert Osborn, of Ames, Iowa: Specimens of *Cittotænia præcoquis.* Prof. M. J. Elrod, of Bloomington, Illinois: Specimens of *Bertia americana.* Mr. J. H. Tallichet, of Austin, Texas: Specimens of *Davainea salmoni* and *Cittotænia variabilis.* Dr. A. K. Fisher, Division of Mammalogy and Ornithology, United States Department of Agriculture: Specimens of *Davainea retractilis.* Mr. Robert A. Mills, of Chuluota, Florida: Specimens of *Cittotænia variabilis imbricata.* Dr. Austin Peters, of Boston, Massachusetts: Specimens of *C. variabilis.*

The other material[2] used belonged to collection of Bureau of Animal Industry (collected by Curtice, Hassall, Stiles); collection of the United States National Museum; collection of Leidy (University of Pennsylvania), and collection of Stiles (United States National Museum).

Although this article treats primarily of leporine cestodes, it has been found necessary to include several forms from other hosts for comparison.

To my assistant, Albert Hassall, I am indebted for the entire technique connected with the specimens used, and also for the preparation of the bibliography, and to Mr. W. S. D. Haines, artist of the Bureau of Animal Industry, Department of Agriculture, for preparing the plates.

Unfortunately much of the material at my disposal was poorly

[1] For a detailed discussion of this subject cf. Stiles: Report upon the Present Knowledge of the Tapeworms of Poultry, Bull. 12, Bureau of Animal Industry, U. S. Department of Agriculture, 1896, pp. 7–73, pls. I–XXI.

[2] Since issuing my preliminary note on this group, I have received the following specimens from the gentlemen mentioned:

Prof. A. Moniez, of Lille: His entire collection of anoplocephaline cestodes, including the type specimen of *Tænia wimerosa* and undetermined specimens of *Cittotænia denticulata* and *C. pectinata.* Geheimrath Rudolf Leuckart, of Leipzig: cotypes of Riehm's *Tænia rhopalocephala* and *T. rhopaliocephala* and one of Meyner's originals of *Tænia (Bertia) mucronata.* Dr. Victor A. Norgaard, of Alice, Texas: Specimens of *Davainea salmoni.* Dr. O. von Linstow, of Göttingen: Specimen of *Cittotænia pectinata.* Dr. von Marenzeller, of Vienna: Several of Riehm's cotypes. Dr. Collin, of Berlin: Rudolphi's cotypes of *Tænia denticulata.*

The manuscript of this article was delayed in order that these specimens could be studied and the results incorporated in the revision.

preserved, so that a number of points I have been obliged to leave for further study. The present study, however, reduces the known leporine forms (*Andrya* and *Bertia* excepted) to a comparatively satisfactory system.

It must be held in mind that every classification proposed for the Cestoda for some years to come is experimental and provisional, for helminthology is not yet so far advanced that we can tell with any degree of certainty what characters or combinations of characters should be looked upon as of family, subfamily, generic, subgeneric, specific, and varietal value, and what characters should be attributed to host-influence.

Date of American species.—"Notes on Parasites—38: Preliminary note to 'A Revision of the Adult Leporine Cestodes,'"[1] established August 28, 1895, as the date of the new specific names used in this paper.

Important notice to helminthologists.—Owing to the fact that Hassall and I have been using material from different helminthological collections, more particularly from the collection of the Bureau of Animal Industry, collection of the United States National Museum, collection of Hassall, collection of Stiles, and collection of Leidy (University of Pennsylvania) bearing parallel current numbers, some confusion has arisen because the same number sometimes appears in all five collections. These five collections were commenced independently, and as their union (temporary or permanent) was not foreseen, this duplication of numbers could not be avoided.

To avoid such confusion in the future as far as possible, the collection of the Bureau of Animal Industry and collection of Stiles will be covered into the United States National Museum, and receive the current numbers of the helminthological collection of the Museum.

The numbers which have been published will not be affected by this change, so far as can now be foreseen. The numbers of a few of the specimens which have been distributed, however, will in all probability be changed. Records of these specimens have been kept in the Zoological Laboratory, Bureau of Animal Industry, and new labels bearing the new numbers will be written and mailed to specialists and museums possessing such specimens as are affected by the renumbering of the collections.

The Leidy collection, as I have stated in another publication, is deposited with me only temporarily and will be eventually returned to the University of Pennsylvania. Duplicates, however, will be kept with the United States National Museum.

Family TÆNIIDÆ.

Diagnosis.—Cestoda with distinctly segmented strobila; head provided with four cup shaped suckers; rostellum well developed, or

[1] Vet. Mag., II, June, 1895, pp. 341-346, issued Aug. 28, 1895.

rudimentary and not always evident (? or entirely absent); genital pores generally lateral; uterus without special pore.

Type genus.—*Tænia*, Linnæus, 1758.

All of the leporine cestodes known at present belong to the family Tæniidæ, in which most authors place indiscriminately all tapeworms provided with four cup-like suckers. Were this family subjected to revision by any set of zoologists except helminthologists, it would undoubtedly soon be raised to superfamily rank at least, and divided into several families, subfamilies, and numerous genera. Most helminthologists, however, are very conservative in proposing genera, even when very prolific in establishing species! A superfamily Tænioideæ will, I believe, soon be established, but this step it will be well to postpone until the cestodes of birds are brought into better order.

ANALYTICAL KEY TO THE GENERA OF ADULT TAPEWORMS FOUND IN LEPUS.[1]

1. Head unarmed; genital pores single or double; ova with pyriform body. ..... *Anoplocephalinæ* 2
   Head armed with numerous hooks on the rostellum and suckers; genital pores single; ova without pyriform body..... *Davainea* (p. 194.)
2. Genital pores double; single pores a rare exception and then in strobilæ containing double pores..... *Cittotænia* (p. 170.)
   Genital pores single 3
3. Genital pores unilateral; testicles unilateral or nearly so, in portion of median field opposite pores; uterus transverse with proximal and distal egg pouches; no separate and distinct prostatic gland present..... *Anoplocephala* (p. 150.)
   Genital pores irregularly alternate; testicles extend across the median field to or beyond the ovary; uterus appears as a network or as a transverse tube with egg pouches..... 4
4. Separate and distinct prostata wanting; uterus a transverse tube with proximal and distal egg pouches..... *Bertia* (p. 160.)
   Separate and distinct prostata present; uterus reticulate; genital pores show a marked tendency to unilaterality..... *Andrya* (p. 154.)

Subfamily ANOPLOCEPHALINÆ, R. Blanchard, 1891.

Diagnosis.—Tæniidæ with unarmed head; genital pores lateral, single or double; segments nearly always broader than long; uterus transverse and tubular, or reticulate; ventral canals always well developed; dorsal canals generally less developed; ova generally with pyriform body; calcareous bodies present or absent.

Type genus.—*Anoplocephala*, E. Blanchard, 1848.

Riehm[2] in 1881 placed the three double-pored rabbit cestodes known to him in the genera *Dipylidium*, R. Leuckart, and *Cittotænia*, Riehm, and the single-pored forms in *Tænia;* in his second[3] paper he placed

[1] See also p. 213.

[2] Zeitschr. ges. Naturw., 3 ser., VI, p. 200.

[3] Studien an Cestoden, Zeit. ges. Naturw., 3 ser., VI, pp. 545–610.

all the double-pored forms in *Dipylidium*. R. Blanchard[1] in 1891 placed the double-pored forms in *Moniezia*, the single-pored forms in *Anoplocephala;* Stiles[2] in 1893 separated the double-pored forms from *Moniezia*, but did not establish any genus for them; Railliet[3] in 1893 created the genus *Ctenotænia* for the double-pored forms and *Andrya* for the single-pored forms.

My studies now lead me to adopt *Cittotænia* for the double-pored leporine cestodes, and to divide the unarmed single-pored forms between the genera *Anoplocephala*, *Andrya*, and *Bertia*.

Genus ANOPLOCEPHALA, E. Blanchard, 1848 (nec Stål 1870).

1848, *Anoplocephala*, E. BLANCHARD, Ann. des Sci. nat., 3 ser., Zool., X, p. 344. Type by elimination, *Tænia equina perfoliata*, Goeze, 1782.

1871, *Plagiotænia*,[4] PETERS, Proc. Zool. Soc. Lond., p. 146. Type, *Tænia gigantea*, Peters, 1856.

1891, "*Plagotænia*, PETERS, 1871" (as synonym) in R. BLANCHARD, Mém. Soc. zool. France, IV, p. 446.

Diagnosis.—Anoplocephalinæ with segments broader than long. One set each of male and female organs in each segment; genital pores unilateral (dextral[5]); testicles in the aporose, ovary in the pore side of the median field. Uterus a transverse tube with proximal and distal pouches. Dorsal canals lie dorsal or lateral of ventral canal. Genital canals cross the longitudinal canals and nerves dorsally. Calcareous bodies (always?) absent from parenchyma. Eggs with well-developed pyriform body. *Hosts:* Perissodactyla, Rodentia.

Type.—A. perfoliata (Goeze, 1872), E. Blanchard, 1848.

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[1] Sur les Helminthes des Primates Anthropoides, Mém. Soc. zool. France, IV, pp. 186–196. Notices helminthologiques: 7.—Cestodes du groupe des Anoplocephalinæ R. Blanchard, 1891, Mém. Soc. zool. France, IV, pp. 443–450.

[2] A Revision of the Adult Cestodes of Cattle, Sheep, and Allied Animals, Bull. IV, Bur. An. Ind., U. S. Dept. Agric.

[3] Traité Zool. méd. et agric., I.

[4] Max Braun (1894, Vermes, 36–37 Lieferung, p. 1138) erroneously gives the date of this genus as 1870; R. Blanchard spells the generic name *Plagotænia*. A typographical error in R. Blanchard, 1891, p. 446, gives *Anoplocephala* the date of 1868, while Braun (loc. cit., p. 1133) dates the genus 1847. Errors of this kind naturally creep into every author's writing. In this connection I would call attention to the list of Cestoda given by Braun (loc. cit., pp. 1133–1145). While this list is extremely valuable in tracing the different species, it must not be looked upon as complete; furthermore, care must be exercised in using the dates of species given by Braun. Rudolphi's species of 1810 are erroneously given as 1808; Krabbe's species of 1869 are erroneously given as 1870. A number of other species are also incorrectly dated.

[5] In *A. wimerosa* the pores are evidently dextral, but in the other species I am unable to determine whether they are dextral or sinistral, either from the figures or descriptions given by various workers. In one of my preparations of *A. mamillana* they are certainly sinistral; in another preparation they are apparently dextral. Professor Zschokke has reexamined his preparations of *A. mamillana* at my request and writes me that he finds the pores dextral, which agrees with the topography found upon a preparation by Railliet very recently sent to me.

R. Blanchard in 1891 admitted the following species to this genus:

A. perfoliata[1] (Goeze, 1782).
A. mamillana (Mehlis, 1831).
A. plicata (Zeder, 1800).
A. transversaria (Krabbe, 1879).
A. wimerosa (Moniez, 1880).
A. globiceps[2] (Diesing, 1856).
A. blanchardi, Moniez, 1891.
A. zebræ (Rudolphi, 1810).
A. hyracis (Rudolphi, 1810).
A. gigantea (Peters, 1856).
Tænia rhopalocephala, Riehm, 1881.
T. rhopaliocephala, Riehm, 1881.

Two of these species, *Tænia rhopalocephala* and *T. rhopaliocephala*, I refer with Railliet to the genus *Andrya* (vide, p. 154). Of the other species, *A. wimerosa* is the only one which occurs in rabbits. This form is very closely allied to *A. mamillana* of the horse and *A. transversaria* of the marmot, which are here introduced for comparison. Several of the remaining forms require further study before their generic position can be looked upon as fully established. Setti (1893) refers *Arhynchotænia critica* Pagenstecher, 1877, and *Tænia ragazzii* Setti, 1891, from *Hyrax* to this genus.

ANOPLOCEPHALA WIMEROSA (Moniez, 1880), R. Blanchard, 1891.

(Plate V, figs. 1–7.)

1880,[3] *Tænia wimerosa*, MONIEZ, Bull. scientif. du Départ. du Nord, 2 ser., 3 ann., no. 6, Juin, pp. 240–242.

1891, *Anoplocephala wimerosa* (MONIEZ, 1880), R. BLANCHARD, Mém. Soc. zool. France, IV, p. 187, p. 449.

1893, *Andrya wimerosa* (MONIEZ, 1880), RAILLIET, Traité de Zool. méd. et agric., I, p. 283.

Moniez, in 1880, described as *T. wimerosa* a cestode which he found in *Lepus cuniculus* at Wimereux. His description reads as follows:

[p. 241.] Le *Tænia Wimerosa* appartient au type du *Tænia expansa*. Observé à l'œil nu ou sous de faibles grossissements, cette espèce qui atteint à peine un centimètre de long sur une largeur de un millimètre et demi, se présente avec un corps épais, formé d'une dizaine d'anneaux seulement. La tête est grosse, les ventouses écartées, il n'y a ni bulbe ni crochets, le cou est nul. Les anneaux s'accusent d'abord par des plis accentués; leur rebord inférieur très saillant est arrondi et orné d'une série de cils élégamment disposés; leur aspect rappelle celui des cils des ventouses dont j'ai parlé ailleurs à propos de la Ligule.

L'appareil génital n'est pas double dans cette espèce comme chez beaucoup d'Inermes et, par une autre particularité, tous les anneaux le portent du même côté. En même temps, l'ouverture génitale débouche au rebord inférieur de l'anneau, bien

[1] The tapeworms of the horse should be subjected to an anatomical revision, and at the same time their specific names should be correctly established. I refrain from attempting to straighten out these names at present, as this can be done satisfactorily only when one has a good line of specimens before him. The tapeworms of horses are unfortunately very poorly represented in the Bureau of Animal Industry collection.

[2] Lühe, 1895 B, pp. 202–205, has recently reexamined Diesing's type material of this species, and has shown it to be an unquestionable *Anoplocephala*.

[3] The citations immediately following the specific names include only those articles which have a direct bearing on the synonymy s. st.; other references are cited in the text by date of publication. (See Bibliography, p. 222.)

que la poche péniale soit située exactement en son milieu; le pénis, qui est très long, décrit donc pour sortir une courbe accentuée. La saillie que ce dernier organe peut faire en dehors est considérable.

Le développement de la poche péniale imprime des modifications particulières à la forme de cet animal. La poche péniale occupe d'abord la plus grande partie de l'anneau; par suite de la rapidité de son développement, qui marche beaucoup plus vite que celui du reste de l'anneau, elle forme, sur le bord, une saillie très forte qui s'efface à mesure que l'anneau grandit. La symétrie se trouve ainsi rétablie, mais le développement des œufs fait bientôt disparaître complètement l'énorme poche péniale.

Les forts grossissements permettent de voir les œufs; dont les caractères sont ceux des œufs des Tænias inermes [p. 242] vrais; leur appareil pyriforme est très développé. Les muscles longitudinaux sont gros et forment une zône continue et peu épaisse. La zône de prolifération est très étendue et sous-jacente aux ventouses.

Blanchard in 1891 found the same form in *Lepus variabilis* and determined it as an *Anoplocephala*.

Railliet in 1893 transferred it to his genus *Andrya*.

Through the kindness of Blanchard, I obtained a number of his specimens upon which the following details are based:

The worms attain 10 mm. in length by 2 mm. in breadth. The head is unarmed, nearly square when viewed *en face*, measuring about 0.78 to 0.88 mm. broad; it sits like a knob on the end of the strobila, from which it is sharply defined. No rostellum was visible. The four suckers are powerful, having a diameter of nearly 0.4 mm. Neck absent segmentation beginning immediately back of the head; as many as 28 segments are present in some individuals. The anterior segments are much broader than long and somewhat asymmetrical; the posterior segments may measure 2.24 mm. broad by 0.8 mm. long; in some cases they become nearly as long as broad. The genital pores are unilateral and dextral.

The reproductive glands are confined to the anterior third of the worm, while the posterior two-thirds are occupied by the uterus. The genital pore becomes almost or quite obliterated upon the atrophy of the glands. The testicles are confined entirely to the aporose side of the segment, as is the case with *Anoplocephala mamillana* and *A. transversaria*.

This parasite is very closely allied to *A. mamillana* of the horse. From the descriptions of former authors and from my own studies, I propose the following as a revised specific diagnosis:

Diagnosis.—Anoplocephala wimerosa (Moniez, 1880), R. Blanchard, 1891: Strobila attains 10 mm. in length by 1.5 to 2.25 mm. in breadth, and contains from 10 to 28 segments which are always broader than long; proximal segments often asymmetrical in outline. Distal segments attain about 2.25 mm. broad by 0.8 mm. long, rarely becoming nearly as long as broad. Head unarmed, nearly cuboid, measuring 0.7 to 0.88 mm., and sits like a knob on the end of the strobila; rostellum not observed; suckers 0.4 mm. in diameter, prominent, rounded, opening diagonally forward; posterior lobes absent. Neck absent. Genital pores unilateral, dextral. The sexual glands are confined to the

proximal third of the worm, the uterus occupying the distal two-thirds. Male organs: Testicles about 15 to 30 in a segment, left of the median line; they appear in the first or second segment, and atrophy by the fifteenth; cirrus-pouch dorsal of vagina, attains 0.48 mm. in length, crossing the longitudinal canals dorsally. Female organs: Ovary appears in earliest segments in about the median line, and atrophies earlier than the testicles; receptaculum seminis elongate; uterus ventral, transverse with distal and proximal pouches. Ova 52 μ in diameter, pyriform body 12 μ, horns crossed. Dorsal canal dorsal to lateral of ventral canal. Genital canals pass dorsally of longitudinal canals and nerves.

Hosts.—European Rabbit (*Lepus cuniculus*) by Moniez; Mountain Hare (*L. variabilis*) by R. Blanchard.

Type.—No. 1452, U.S.N.M., belongs to collection of Moniez. Typical specimens in collection of R. Blanchard (Paris);[1] collection of Bureau of Animal Industry;[1] collection of Stiles (U.S.N.M.);[1] Nos. 112, 1353, 1358, 1359, 1360, 1361, U.S.N.M.;[1] collection of Hassall;[1] collection of Leidy (University of Pennsylvania);[1] collection of Harvard University;[1] collection of H. B. Ward.

Geographical distribution.—France: Wimereux (by Moniez); Briançon, by R. Blanchard.

ANOPLOCEPHALA MAMILLANA (Mehlis, 1831), R. Blanchard, 1891.

(Plates V, fig. 8; VI, figs. 1–3.)

1831, *Tænia mamillana*, MEHLIS, Gurlt's Lehrbuch d. path. Anat. d. Haussäugethiere, I, p. 380, pl. IX, figs. 7, 11.

1891, *Anoplocephala mamillana* (MEHLIS, 1831), R. BLANCHARD, Mém. Soc. zool. France, IV, p. 187.

Diagnosis.—*Anoplocephala mamillana* (Mehlis, 1831), R. Blanchard, 1891: Strobila attains 6 to 30 mm. in length by 4 to 6 mm. in breadth. Head unarmed, 0.7 to 0.8 mm. broad by 0.5 mm. long; suckers very muscular, elliptical with elongate openings; posterior lobes absent. Neck absent. Thirty-five to fifty-two segments present, the distal 4 to 8 completely filled with ova; sexually active segments 3 to 5 mm. broad by 0.3 to 0.6 mm. long; posterior segments may attain 2 mm. in length. Genital pores unilateral in posterior half of lateral margin. Male organs: Testicles confined to aporose side of segment, appearing in the first segments, and atrophying by the seventeenth to eighteenth segments; they are 60 to 100 in number; cirrus-pouch well developed, may attain 0.8 mm. in length, cirrus spinous. Female organs: Vagina ventral of cirrus-pouch; ovary visible in seventh segment, reaches its highest development in thirteenth to sixteenth and atrophies in twentieth to twenty-second; it is situated slightly to the right of the median line; receptaculum seminis globular; the transverse uterus appears in fifth or sixth segment, develops proximal and distal pouches, and begins to fill about the fifteenth segment; eggs oval, 88 μ by 50 to 60 μ.

[1] Specimens distributed from collection of R. Blanchard.

Dorsal canal dorsal to lateral of ventral canal. Genital canals pass dorsally of longitudinal canals and nerves.

Host.—Horse (*Equus caballus*).

This diagnosis is based in part upon the anatomical discussion of this worm by Zschokke,[1] in 1888.

ANOPLOCEPHALA TRANSVERSARIA (Krabbe, 1879), R. Blanchard, 1891.

(Plate VI, figs. 4–7.)

1879, *Tænia transversaria* KRABBE, Verh. d. K. Ges. d. Frde. d. Natur, Anthropol. und Ethnographie, XXXIV, Moskau, pp. 2–3, figs. 1–6.

1891, *Anoplocephala transversaria* (KRABBE, 1879), R. BLANCHARD, Mém. Soc. zool. France, IV, p. 448.

Diagnosis.—*Anoplocephala transversaria* (Krabbe, 1879), R. Blanchard, 1891: Strobila attains 10 to 16 cm. in length by 6 to 8 mm.[2] in breadth, and is composed of 200 to 300 segments. Head distinct, 0.6 to 0.8 mm. broad by 0.6 mm. long, suckers powerful and prominent; posterior lobes absent; neck absent. Genital pores unilateral at about the middle of the margin. Male organs: 60 to 80 testicles to each segment, confined to the aporose portion of the median field; cirrus-pouch large. Female organs: Vulva ventral of cirrus-pouch; receptaculum seminis elongate; ovary in pore-side portion of median field; uterus transverse, with pouches. Dorsal canal lateral of ventral canal. Genital canals pass the longitudinal canals and nerves dorsally. Ova with well-developed pyriform body.

Host.—*Arctomys*, sp.; in Turkestan by Fedschenko.

Diagnosis is based on Zschokke's anatomical discussion in 1888.[3]

Genus ANDRYA, Railliet, 1893.

1893, *Andrya*, RAILLIET, Traité de Zoologie médicale et agricole, I, p. 283. Type, *Tænia rhopalocephala*, Riehm, 1881.

Provisional diagnosis.—Anoplocephalinæ with segments broader than long, or as long as broad. One set each of male and female organs to each segment; genital pores irregularly alternate with marked tendency to unilaterality; female glands in median field on pore side of median line; uterus appears as a network with peripheral dichotomous branches and afterwards assumes a more saccular form; testicles confined to median field; a distinct round or elongate pedunculated prostatic gland near ventral canal on pore side of median field; genital canals pass dorsally of ventral (and ? dorsal) canal and nerve. Dorsal canal dorsal to dorso—(? lateral) of ventral canal. Calcareous corpuscles develop in distal portion of strobila. Egg with well-developed pyriform body, the horns of which are rather short. *Hosts:* Rodents.

Type.—*Andrya rhopalocephala* (Riehm, 1881), Stiles, 1895.

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[1] Reches. Struc. Anat. et Histl. des Cestodes, Genève, pp. 18-46, figs. 1–14.

[2] There is evidently a typographical error in Zschokke's figures, for he gives the breadth of the mature segments at 0.6 to 0.8 mm., yet states on the same page that the proglottids are 0.5 mm. long, and twelve times as broad as long.

[3] Reches. Struc. Anat. et Histl. des Cestodes, Genève, 1888, pp. 47–63, figs. 15–20.

The genus *Andrya* was proposed by Railliet in the following words:

Il n'est pas douteux, bien que leur étude anatomique soit encore peu avancée, que les anoplocéphalinés des Rongeurs, pourvus de pores génitaux alternes, doivent être séparés génériquement de ceux des Équidés, qui ont les pores génitaux unilatéraux. Nous en faisons donc le genre *Andrya*, d'après le *Tænia rhopalocephala* Riehm, et en l'honneur de Nicolas Andry, le savant médecin du XVIIe siècle, qui a contribué l'un des premiers à élucider l'histoire des Téniadés.

Besides the type-species, Railliet placed here *Tænia rhopaliocephala*, Riehm (= *Anoplocephala cuniculi*, R. Blanchard), and *T. wimerosa*, Moniez. The latter species I return to the genus *Anoplocephala* (p. 151). In my preliminary note in 1895 I placed an American form (*Andrya americana*) in Railliet's genus, but since examining Meyner's specimens of *Bertia mucronata* I am inclined to transfer *A. americana* to the genus *Bertia*, see p. 165. Regarding the validity of the genus *Andrya*, see p. 164. Of Riehm's original material I have obtained the following specimens:

Cotypes of Riehm's Tænia rhopalocephala and *Tænia rhopaliocephala.*

U. S. N. M. number.	Label.		Received from—	Redetermined as—
	Parasite.	Host.		
1377	Tænia rhopalocephala.	Lepus timidus....	Vienna Museum..	Andrya cuniculi.
1378	.....do.....	Lepus cuniculus..	.....do	Do.?
1379	.....do.....	Lepus timidus....	.....do	Andrya rhopalocephala.
1484	Tænia rhopaliocephala	.....do	Leuckart	Do.
1485	Tænia rhopalocephala.	.....do	.....do	Do.?

All of these specimens were evidently originally determined by Riehm, who, however, trusted too much to the external form of the segments, for a careful comparison of the worms with Riehm's figures and description shows that some of the specimens were misdetermined.

Riehm states that his *T. rhopalocephala* was found only in *Lepus timidus*, while *T. rhopaliocephala* (=*Andrya cuniculi*) was confined to *Lepus cuniculus*. Whether the discrepancies between his labels and this statement are due to an error in host determination or an error in writing the labels of the specimens is a point which, of course, can not now be settled. For the present I adopt his statements and assume an error in the labels. If both host determination and labels are correct, then *Andrya cuniculi* must also occur in *Lepus timidus*. This point must be settled by new collection of material.

None of the specimens are in very good condition, on which account I am unable to enter into a detailed study of the organs. My observations, however, lead me to accept both species as well founded, and my results agree in general with those obtained by Riehm.

ANDRYA RHOPALOCEPHALA (Riehm, 1881), Stiles, 1895.

(Plates VII, figs. 1-7; VIII, 1-3.)

†1800, *Alyselminthus pectinatus* (GOEZE, 1782), ZEDER, Erster Nachtrag z. Naturg. der Eingeweidewürmer, Leipzig, p. 246-249.

†1803, *Halysis pectinata* (GOEZE, 1782), ZEDER, Anleitung z. Naturg. der Eingeweidewürmer, p. 332.

1881, *Tænia rhopalocephala*, RIEHM, Zeitschr. f. d. ges. Naturwiss., 3 ser., VI, p. 200; 551-562, pl. v, figs. 1, 7-10, 18, vi, 1.

1891, *Anoplocephala rhopalocephala* (RIEHM, 1881), R. BLANCHARD, Mém. Soc. zool. France, IV, p. 448.

1893, *Andrya pectinata* ([GOEZE, 1782] ZEDER, 1800), RAILLIET, Traité de Zool. méd. et agric., I, p. 283.

1895, *Andyra rhopalocephala* (RIEHM, 1881), STILES, Vet. Mag., II, pp. 343, 344.

I can find no evidence that Goeze (1782) had any single-pored forms before him when he described his *Tænia pectinata*. Zeder[1] in 1800 redescribed what he supposed was Goeze's species, but states that the pores were single. Riehm[2] in 1881 considered Zeder's species identical with the one now under consideration, and authors have followed him in this opinion. Zeder's description appears to me, however, altogether too fragmentary to accept this view as proven; at the same time it is impossible to definitely disprove Riehm's conclusion. Riehm[3] in 1881 was the first to recognize *Tænia rhopalocephala* as a distinct form; his revised diagnosis[4] reads as follows:

Kopf hakenlos, gross und keulenförmig, mit stark vorspringenden, mächtigen Saugnäpfen, scharf abgesetzt gegen den Halstheil. Geschlechtsöffnungen einfach im unteren Viertheil des Proglottidenrandes gelegen, meist durchgängig auf derselben Seite. Glieder trapezförmig, etwa eben so breit als lang. Länge im ausgestreckten Zustande 60—80 cm., Breite der reifsten Glieder wenig über 5 mm. Wohnthier: *Lepus timidus*.

Blanchard[5] in 1891 transferred Riehm's species to the genus *Anoplocephala*, while Railliet[6] in 1893 took it as type of the genus *Andrya*. Railliet reverted to Zeder's specific name, but I now adopt *rhopalocephala* on the ground that Zeder's *pectinata* was not proposed as a name for a new species, but Zeder was under the impression that he was redescribing Goeze's form. *Andrya rhopalocephala* has not yet been recorded for this country. The following statements are based upon Riehm's specimen (No. 1484, U.S.N.M.), mentioned on p. 155.

The anlage of the genital canals and female glands appears earlier than the testicles. In the lateral third of the segment on the pore side the undifferentiated anlage of the canals may be distinguished in the distal portion of the segment, and at its median end it becomes widened to form the anlage of the female glands. The anlage of the canals gradually thickens while the portion destined to form the female glands becomes more or less distinctly separated from it. At a time when this apparent separation takes place, small, quite indistinct, points of chromatophile material appear in the aporose portion of the median field and form the anlagen of the testicles. The segment now

[1] Erster Nachtrag zur Natur. der Eingew., Leipzig, pp. 246-249.

[2] Stud. an Cestoden, Zeit. ges. Nat., 3 ser., VI, pp. 545-546, pl. v-vi.

[3] [Untersuchungen an den Bandwürmern der Hasen und Kaninchen], Zeitschr. ges. Naturw., 3 ser., VI, p. 200.

[4] Studien an Cestoden, Zeitschr. ges. Naturw., 3 ser., VI, p. 551.

[5] Mém. Soc. zool. France, IV, p. 448.

[6] Traité de Zool. méd. et agric., 1, p. 283.

measures about 0.9 mm. broad by 0.35 mm. long. The anlage of the canals next becomes differentiated into the anlagen of the male and the female ducts, and the anlage of the female glands divides into the anlagen of the separate glands. The testicles are now distinct; the segments measure 1 mm. broad by 0.64 mm. long. The ovarial tubes then become distinct, the receptaculum seminis appears and increases in size, and the elongated prostata and the cirrus pouch develop. The developed cirrus pouch measures about 0.32 mm. long by 0.16 mm. broad. In the meantime the testicles have encroached upon the pore side of the segment anterior to the ovary. The next change in the segments is brought about by the development of the uterus, which gradually hides the testicles from view. As my material is very poorly preserved, and hence does not stain altogether satisfactorily, the description of the various stages of the uterus must be left for some one who can obtain fresh specimens. Plate VII, fig. 7, represents a segment measuring 2.08 mm. broad. The cirrus pouch with the enclosed inverted cirrus is the only portion of the male organs which is now visible. The female glands have also disappeared, but the receptaculum seminis is still present. The uterus fills the entire median field of the segment and appears as a reticulate structure, with dichotomous branches on the periphery. As the ova develop, the boundaries between the different branches of the network become more and more indistinct and the uterus assumes the form of a simple sac (Plate VIII, fig. 1), in which no divisions, or at most extremely fragmentary and rudimentary divisions, are visible. The cirrus pouch and the receptaculum seminis are still present.

Whether this uterus is primarily an actual network, or whether it is originally a simple tube with numerous proximal and distal branches which secondarily anastomose and then gradually disappear to form a common simple sac, can not be stated at present with certainty, but with the data now at hand, I incline decidedly to the latter view.

The ova measure 52 to 60 μ; the pyriform body measures 12 μ broad by 28 μ long (horns included).

In the younger segments no calcareous corpuscles are visible. When the ova in the uterus become more distinct and the partitions in the uterus become less distinct, a few calcareous corpuscles appear in the cortical portion of the segments. As the shells of the ova develop, the calcareous corpuscles become numerous.

From Riehm's anatomical description and from my own study, I propose the following as a revised specific diagnosis:

Diagnosis.—*Andrya rhopalocephala* (Riehm, 1881), Stiles, 1895: Strobila attains 60 to 80 cm. in length by 5 mm. in breadth. Head unarmed, about 1 mm. in diameter, nearly quadrate in apex view. Neck about 1 mm. long. Segments 500 to 600 in number; active segments slightly broader than long; segments gradually increase in length so that posterior segments are as long as broad; they may attain 5 to 5.5 mm. in breadth. Genital pores single, near posterior corner of the segment,

for the greater part unilateral. Genital organs appear in about the one-hundredth segment. Male organs: Testicles dorsal, comparatively few in number, 75 to 80 μ in diameter, and more numerous in the aporose than in the pore side of the segment; cirrus pouch 0.32 to 0.34 mm. long by 0.16 mm. broad; cirrus short, generally lies in two spirals within the pouch; prostata elongate. Female organs: Vagina slightly distal of cirrus pouch, swells to a large receptaculum seminis median and dorsal of ventral canal; ovary, shell-gland, and vitellogene gland distal in pore half of median field; uterus ventral, appears as an apparent network with dichotomous peripheral branches, and finally forms a sac with indistinct partitions or without partitions. Ova 52 to 60 μ; pyriform body 12 μ broad by 28 μ long. Calcareous bodies appear in segments containing ova, and become numerous in segments in which the egg shells are distinct.

Host.—European Hare (*Lepus timidus*) by Riehm in Saxony.

Cotypes.—Nos. 1379, 1484, 1485, U.S.N.M.; collection of Leuckart; Vienna Museum.

ANDRYA CUNICULI (R. Blanchard, 1891), Railliet, 1893.

Plates VIII, figs. 4–8; IX, fig. 1.

1881, *Tænia rhopalocephala* [nec *rhopalocephala*] RIEHM, Zeitschr. f. d. ges. Naturwiss., 3 ser., VI, pp. 562–565, pls. V, fig. 2, VI. fig. 3.

1891, *Anoplocephala cuniculi*, R. BLANCHARD, Mém. Soc. zool. France, IV, p. 447.

1893, *Andrya cuniculi* (R. BLANCHARD, 1891), RAILLIET, Traité d. Zool. méd. et agric., I, p. 283.

Riehm described this form in 1881 under the following diagnosis:

Kopf hakenlos, klein, aber gegen den sehr dünnen Halstheil stark keulenförmig abgesetzt, wenn letztere nicht zu stark contrahiert ist. Geschlechtsöffnungen einfach, im dritten Viertheil des Proglottidenrandes gelegen; Glieder trapezförmig, etwa eben so lang wie breit. Länge im ausgestreckten Zustande bis 100 cm., Breite der reifsten Glieder bis zu 8 mm. Wohnthier: *Lepus cuniculus*.

Blanchard in 1891 changed the name to *cuniculi* on grounds of articles 54 to 55 of the International Code, and placed the worm in the genus *Anoplocephala*. Railliet in 1893 placed the form in the genus *Andrya*.

I have not yet found this species in the United States, but have been fortunate enough, through the kindness of Geheimrath Leuckart and Dr. von Marenzeller, to obtain some of Riehm's original stock.

One of the specimens, which was mounted whole, shows the following details: The anterior end is very narrow (0.4 mm.) and segmentation is scarcely visible, so that only the head and a portion of the neck have been lost. Segmentation is noticed 0.64 mm. from the anterior extremity, while 2 mm. from the end the segments are perfectly distinct, measuring 0.8 mm. broad by 0.24 mm. long. The anlagen of the female organs are indistinctly visible at about this point; they lie close to the pore side of the segment, but owing to the poor condition of the material they can not be analyzed. Testicles could not be distinguished in

these segments, but they appear about twenty segments later, soon becoming numerous and distinct and occupy the entire median field except the portion taken up by the female organs. Plate VIII, fig. 6, represents four segments about 15 mm. from the anterior end. About forty testicles are present. The anlage of the female glands is near the median line in the pore side of the median field; it is roundish and not very prominent. The genital canals are not very distinct, but may be traced to the lateral margin. Plate VIII, fig. 7, represents three segments about 30 mm. from the anterior end. The testicles have increased in number and size; the ovary and vitellarium are distinct, but the shell-gland is scarcely visible; the genital canals have become well differentiated, and the pore has developed. The greater majority of the genital pores are on one side of the strobila, and are situated in the distal half of the margin. In the specimen under discussion they range about as follows:

15.	16.	119.	44.	7.	5.	9.
4.	4.	6.	6.	2.	2.	18.' etc.

About 50 mm. from the anterior extremity the structure of the segment becomes complicated by the development of the uterus. My preparation does not permit a study of its gradual development, but this organ appears to be much more complicated than one would expect from Riehm's description. At first no distinct limits can be made out, and one sees only numerous ova scattered through the segment. As the testicles atrophy, however, and the uterus comes more distinctly into view, the latter is apparently composed of a network of anastomosing tubes, much like the uteri found in *Moniezia*, and totally different from the transverse uterus found in *Cittotænia*, *Bertia*, and *Anoplocephala*. As in the case of the anastomosed testicles of *Fasciola*, it is here often impossible to distinguish whether we are dealing with anastomosing tubules or branched tubules which lie close together.

My limited material will not warrant a more minute study of the uterus of this form. See also General Remarks, p. 203.

The cirrus pouch is seen to best advantage in segments in which the uterus has begun to develop. It is pyriform and measures 0.4 mm. long by 0.144 mm. broad. It is highly muscular, especially in its proximal portion, and its middle portion contains a prominent dilatation representing a vesicula seminalis. Median to the pouch is found a roundish body, which evidently corresponds to the "prostata" described by Riehm.

The vagina and large elongate receptaculum seminis lie distally of the pouch and vas deferens, as Riehm has already described.

The ova measure 48 to 60 μ in diameter; the pyriform body measures 20 μ broad by 32 to 44 μ long.

The following is proposed as a revised specific diagnosis:

Diagnosis.—Andrya cuniculi (R. Blanchard, 1891), Railliet, 1893: Strobila attains 100 cm. in length by 8 mm. in breadth. Head

unarmed, about 0.5 mm. in diameter; rostellum not observed; neck filiform. Segments 500 to 800 in number, quadrate, broader than long; gravid segments may attain 8 mm. in breadth. Genital pores in about the middle of the margin or in distal half of the margin, irregularly alternate, but for the greater part unilateral. Male organs: Testicles scattered through the entire breadth of the median field; cirrus pouch 0.4 to 0.48 mm. long by 0.14 to 0.16 mm. broad, quite muscular, and contains a distinct vesicula seminalis; prostata round. Female organs: Vagina distal of cirrus swelling to an elongate receptaculum seminis ventral of vas deferens; ovary near median line in pore side of median field; uterus forms a network in median field, but as the ova develop the boundaries of the meshes become quite indistinct. Ova 48 to 60 μ in diameter; pyriform body 20 μ broad by 32 to 44 μ long. Calcareous bodies become numerous in distal segments.

Host.—European wild rabbit (*Lepus cuniculus*) in Saxony by Riehm; ? European hare (*Lepus timidus*), see p. 155.

Cotypes.—Nos. 1377, 1378, U.S.N.M.; collection of Leuckart; Vienna Museum.

Genus BERTIA, R. Blanchard, 1891.

1891, *Bertia*, R. BLANCHARD, Mém. Soc. zool. France, IV, pp. 186–196. Type, *Bertia studeri*, R. Blanchard.

Provisional diagnosis.—Anoplocephalinæ, with segments broader than long. Genital pores regularly or irregularly alternate. Uterus (in all cases?) a transverse tube with proximal and distal egg pouches; genital canals pass dorsally of dorsal and ventral canal and lateral nerve trunk, but in the two cases at least ventrally of dorsal longitudinal nerve; distinct prostatic gland wanting. Dorsal canal dorsal to dorsolateral of ventral canal. Egg with well-developed pyriform body. Calcareous corpuscles present or absent. *Hosts:* Primates and rodents.

Type.—*B. studeri*, R. Blanchard, 1891.

Two years prior to the publication of the genus *Andrya* by Railliet, R. Blanchard, in 1891, proposed the genus *Bertia* for anoplocephaline cestodes with alternate genital pores, taking *B. studeri* from *Anthropopithecus troglodytes* as type of the genus; as second species of the genus he described *B. satyri*.

Unfortunately, on account of paucity of material, Blanchard was unable to give the anatomy of the type species, so that the generic diagnosis was based chiefly upon external characters. His original diagnosis reads as follows:

Caput crassum, subsphæricum, rostro aculeisque carens, acetabulis ellipticis, in dua paria valde distantia dispositis. Collum breve, propre tam largum quam caput. Corpus e permultis annulis brevissimis latisque, imbricatis, constans. Pori genitales marginales, tenuissimi, ab uno annulo ad alterum plus minus regulariter alternantes. In annulo permaturo, ova in plures fasciculos regulares, transverse dispositus, collecta. Oncosphæra pyriforme apparatu circumdata. Involutio ignota.

From Blanchard's descriptions of the species the following may be taken as provisional specific diagnoses.

BERTIA STUDERI, R. Blanchard, 1891.

(Plate IX., figs. 2–3.)

1891, *Bertia studeri*, R. BLANCHARD, Mém. Soc. zool. France, IV, pp. 187–190, figs. 1–4.
1894, *Tænia studeri* (R. BLANCHARD, 1891), BRAUN, Vermes, Bronn's Klassen und Ordnungen, etc., IV, 36–37, p. 1143.

Diagnosis.—Bertia studeri, R. Blanchard, 1891: Strobila attains 130 mm. in length, 15 mm. in breadth, 2.5 mm. in thickness; contains about 400 segments. Head subspherical, 0.65 mm. broad by 0.61 mm. long; suckers oblong, 0.34 to 0.345 mm. long by 0.27 to 0.28 mm. broad, two arranged on dorsal surface, two on ventral surface. Neck very short (0.3 mm.); about as broad as head. Segments always much broader than long; maximum breadth 15 mm. at 45 mm. from head, maximum length about 0.35 mm. Genital pores very small, lateral, alternating very regularly. Male organs: ? Female organs: Glands? Uterus in fully developed stage composed of 30–35 polyhedral packages, 0.5 to 0.9 mm. by 0.1 to 0.8 mm., arranged in transverse row, occupying entire breadth and thickness of segments. Ova 53 to 60 μ, pyriform body 14 to 16 μ broad, 23 to 30 μ long, horns generally straight, oncosphere 10 to 12 μ. Cortical layer of strobila supplied with numerous calcareous corpuscles 15 to 20 μ by 11 to 17 μ.

Host.—Chimpanzee (*Anthropopithecus troglodytes* (Linnæus) [*Troglodytes niger*]), by Studer.

Type.—Type and one paratype in Zoological Museum at Berne, Switzerland. Fragments in collection of R. Blanchard.

BERTIA SATYRI, R. Blanchard, 1891.

1891, *Bertia satyri*, R. BLANCHARD, Mém. Soc. zool., France, IV, pp. 190–192.
1894, *Tænia satyri* (R. BLANCHARD, 1891), BRAUN, Vermes, Bronn's Klassen und Ordnungen, etc., IV, 36–37, p. 1143.

Diagnosis.—Bertia satyri, R. Blanchard, 1891: Strobila attains 245 mm. or more in length by 10 mm. in breadth by 2 mm. in thickness, and contains about 350 segments. Head and neck unknown. Segments always much broader than long, attaining a maximum length of 0.75 mm. Genital pores very small, lateral, irregularly alternate. Calcareous corpuscles numerous, attaining 30 by 20 μ. Dorsal canal lateral of ventral canal. Cirrus-pouch claviform, large and elongated. Uterus resembles somewhat that of *B. studeri*. Ovum 35 to 38 μ by 30 to 32 μ, pyriform body 12 to 17 μ by 19 to 25 μ, oncosphere 13 μ.

Host.—Oran-Utan (*Simia satyrus*, Linnæus).

Type.—Leyden Museum.

From these descriptions it is impossible to come to any satisfactory conclusion as to whether the genera *Andrya* and *Bertia* should be kept separate or united. The form of the segments must surely be rejected as a generic character, and the fact that the pores of *Bertia* show a tendency to appear regularly alternate while those of *Andrya* show

a remarkable tendency to unilaterality can not, unassociated with other characters, be looked upon as establishing the genera as distinct.

In the preliminary note to this revision, I described two American parasites as provisional members of the genus *Andrya*, reserving opinion as to the validity of the genus and calling attention to some important differences in the American and German leporine single-pored forms. Since the publication of my note,[1] I have received a copy of a recent paper by Meyner describing two new species of cestodes, probably allied to the two forms of *Bertia* described by Blanchard, and through the kindness of Geheimrath Leuckart I have obtained one of the cotypes of Meyner's *Tænia* (*Bertia*) *mucronata*. It will be necessary to consider these forms briefly in connection with the leporine parasites.

Meyner evidently accepts *Bertia* only as a subgenus of *Tænia;* as *Bertia* has, however, absolutely no generic relations with *Tænia*, I now change his specific combinations from *Tænia* (*Bertia*) *mucronata* and *T.* (*B.*) *conferta* to *Bertia mucronata* and *B. conferta*.

Meyner discusses the anatomy of these two forms in detail, and from his account the following descriptions may be taken as specific diagnoses:

BERTIA MUCRONATA (Meyner, 1895), Stiles, 1896.

(Plate IX, figs. 4–5.)

1895, *Tænia* (*Bertia*) *mucronata*, MEYNER, Zeitschr. f. Naturw., LXVIII, (5 ser., VI), pp. 1–86, pl. I, figs. 1–7.

Diagnosis.—*Bertia mucronata* (Meyner, 1895), Stiles, 1896: Strobila dagger-shaped, attains 140 mm. or more long by 8 to 10 mm. broad, serrate, imbricate, whitish yellow. Head, 0.34 to 0.714 mm. broad, apex nearly square, rostellum wanting; suckers oval 0.255 mm. broad, 0.2 mm. deep. Neck short, not sharply separated from head. Genital pores irregularly alternate. Male organs: Testicles appear in one hundred and twentieth segment, numerous, 75 to 100 μ in diameter, crowded together in [antero-]dorsal portion of median field. Vas deferens dorso-anterior of vagina; cirrus-pouch not mentioned. Female organs: Glands in pore side of median field; vagina long; receptaculum seminis globular; uterus single, transverse, at first a simple tube appearing in about one hundred and thirtieth segment; eggs enter it in three hundred and fiftieth segment and blind pouches are formed. Ova 36 μ, with three membranes; pyriform body 15 to 16 μ broad; oncosphere 13 to 14.4 μ. Three longitudinal nerves each side of segment, of which middle nerve is the largest. Dorsal canal dorsal of ventral canal. Genital canals pass dorsally of longitudinal canals and longitudinal ventral and main nerves, but ventrally of dorsal nerve. Calcareous bodies 4.9 to 18.4 μ, more numerous in cortical layer; about 150 visible in transverse section of scolex, 10 to 12 visible 10 mm. from anterior extremity, 400 to 500 in transverse section of distal segments.

[1] Notes on Parasites—38: Preliminary note to "A Revision of the Adult Leporine Cestodes," Vet. Mag., 1895, II, p. 341–346.

Host.—Black Howler (*Alouatta caraya* (Humboldt) [*Mycetus niger*]) in Paraguay, collected by Neumeister.

Types.—In collection of Leuckart; one cotype No. 1483, U.S.N.M.

In the cotype of this species at my disposal the uterus is not developed. The worm presents an entirely different appearance from *Andrya*. The muscular cirrus pouch seems to be almost wanting, so far as I can distinguish, the end of the male canal appearing simply as a widened portion of the vas deferens with very weak muscles and much less prominent than the vagina. The prostatic gland, so characteristic for *Andrya rhopalocephala* and *A. cuniculi*, is entirely wanting. Plate IX, figs. 4–5, give the general topographical anatomy of the segment.

I do not believe that the division of the ovary into two wings as described by Meyner can be maintained, for in the cotype this division is extremely irregular. In some cases the ovary is not divided; in other segments it is divided into two, three, or four wings. I further find the dorsal canals dorsal to dorso-lateral of the longitudinal canals.

BERTIA CONFERTA (Meyner, 1895), Stiles, 1896.

(Plate IX, fig. 6.)

1895, *Tænia* (*Bertia*) *conferta*, MEYNER, Zeitschr. f. Naturw., LXVIII (5 ser., VI), pp. 86–103, pl. 1, figs. 8–13.

Diagnosis.—*Bertia conferta* (Meyner, 1895), Stiles, 1896: Strobila attains 84 mm. or more in length by 6.5 mm. in breadth; serrate. Head roundish, 0.68 mm.; rostellum wanting; suckers oval. Neck about 2 mm. long, at first about as broad as the head, from which it is not sharply separated. Segments always much broader than long; sexual segments measure 5.1 mm. broad by 0.27 mm. long by 1.02 mm. thick. Genital pores irregularly alternate. Male organs: Testicles numerous in dorsal portion of median field (in figure, of transverse section confined to aporose two-thirds of median field at plane of genital pore), vas deferens dorso-anterior of vagina, its lateral portion quite wide; cirrus-pouch? Female organs: Glands in middle of pore side of segment; receptaculum seminis oval; vagina with widened ciliated lateral portion. Uterus single, transverse, at first tubular, later with blind sacs. Ova begin to enter uterus 35 mm. from head in about the one hundred and thirtieth segment. Three lateral longitudinal nerves as in *B. mucronata*. Dorsal canal dorsal of ventral canal. Genital canals pass dorsally of longitudinal canals. Calcareous bodies numerous, may attain 19 μ; 20 to 25 visible on transverse section of sexual segments, 600 to 800 on transverse section of distal segments.

Host.—Bonnet Monkey (*Macacus sinicus* (Linnæus) [*Macacus radiatus*]).

Type.—In collection of Leuckart.

While looking upon Meyner's paper as an interesting and important contribution to the knowledge of the worms of this group, I do

not feel justified in utilizing his work as basis for more than a provisional generic diagnosis for *Bertia* until the type species of the genus (*B. studeri*) can be studied more in detail. Nor do I consider the data at hand sufficient to justify a worker in suppressing Railliet's genus *Andrya* in favor of the earlier genus *Bertia*. From the very limited material and data at hand, I am inclined to believe that *Anoplocephala*, *Bertia*, and *Andrya* will all eventually be recognized as good genera, established upon well-recognized anatomical characters, but for the present, although *Anoplocephala* unquestionably stands, *Bertia* and *Andrya* can be accepted only as provisional genera, and as convenient means of classification. The final acceptance of the genera can follow only after examination of a larger series of specimens representing, if possible, more species[1] than are at present included under *Andrya* and *Bertia*.

To utilize the generic terms *Andrya* and *Bertia* provisionally is certainly better than to place the forms in the same genus with *Tænia solium*.

BERTIA PLASTICA (Sluiter, 1896), Stiles, 1896.

1896, *Tænia plastica*, Sluiter, Centralbl. f. Bakteriol., Parasitenk. u. Infektionskr., I Abt., XIX, No. 24, pp. 941-946, figs. 1-6. June 30, 1896.

During the proof reading of this revision an article has appeared by C. Ph. Sluiter, describing a new species of tapeworm (*Tænia plastica*) from *Galeopithecus volans*. Sluiter is inclined to consider this new parasite as very closely related to *Anoplocephala plicata*, *A. mamillana*, and *A. perfoliata*, all of which he retains as members of the genus *Tænia*.

Unfortunately, several important points in the topographical anatomy have been omitted by the author, but his description and figures show that *Tænia plastica* is much more closely related to Meyner's *Tænia* (*Bertia*) *mucronata* than it is to the tapeworms of horses, on which account I transfer it to the genus *Bertia*. From Sluiter's description and figures, the following specific diagnosis is written:

Diagnosis.—*Bertia plastica* (Sluiter, 1896), Stiles, 1896: Strobila more

[1] Gottheil (1887) described two other cestodes, which may have some bearing upon the question, with the following diagnoses:

(*Tænia*) No. 1. Length 20 cm., breadth at largest segment 3.5 mm. Head globular, four suckers, no rostellum, and no hooks. Neck extremely fine and filamentous—2.5 cm. long. Proglottides slowly increase in size, greatest breadth being only attained 15 cm. from head. Sexual orifices at the sides. Segments oblong, 3.5 mm. by 0.75 mm. From Macaque monkey (*Macacus cynomolgus* (Schreber)).

(*Tænia*) No. 2. Length of largest specimen, 15 cm. Breadth at largest segment, 8 mm. Head large and clubbed, four suckers, no rostellum or hooks; neck short and thick; proglottides rapidly increase in size after the first inch and attain their full diameter from head, 7.5 cm. mature proglottides. They overlap each other at their posterior angles. Segments mature measure 8 by 4.5 mm.

From Macaque monkey (*Macacus cynomologus* (Schreber)) and Weeping Capuchin (*Cebus capucinus* (Linnæus)).

From the descriptions and figures it is very possible that these two forms are anoplocephaline cestodes, but Gottheil gives no characters which will aid in definitely determining the question at hand.

or less lanceolate, attaining 24 to 220 mm. in length by 6 to 11 mm. in breadth, and containing 80 to 400 segments. Head about 1 mm. broad by 1 mm. long; suckers round. Neck absent. Proximal segments increase rapidly in breadth; middle segments the broadest; distal segments decrease gradually to 5 mm. in breadth, with more or less crenate and imbricate posterior edge, and measure 0.5 to 0.76 mm. long. Genital pores irregularly alternate in about the middle of the lateral margin; genital cloaca and organs developed in fortieth segment; eggs in uterus in fiftieth segment. Male organs: Cirrus large; cirrus-pouch muscular; testicles occupy chiefly the anterior portion of the segments extending the entire breadth of the median field. Female organs: Vagina distal to cirrus-pouch; receptaculum seminis elongate; vagina and receptaculum together extend about one-third across the segment; ovary very broad, extending nearly or quite to the aporose submedian line; shell-gland and vitollegene gland about in the porose submedian line; uterus tubular, transverse with proximal and distal pouches. Eggs 25 μ in diameter. Topography of nerves and canals?

Host: Flying Lemur (*Galeopithecus volans*), collected by Hubrecht in In India.

Type: ? Deposited in Amsterdam. Technique of type?

BERTIA AMERICANA (Stiles, 1895), Stiles, 1896.

(Plate X, figs. 1–10.)

1855. ? *Tænia laticephala*, LEIDY, Proc. Acad. Nat. Sci. Phila., VII (1854–1855), December, 1855, p. 443.

1895, *Andrya americana*, STILES, Vet. Mag., Phila., II, June, p. 344. Aug. 28, 1895.

Leidy has given a short description of a tapeworm (*Tænia laticephala*) from the Canada Porcupine which agrees in some characters with the form I described (*Andrya americana*) from the yellow-haired Porcupine. I am unable to find Leidy's types, but it seems to me very questionable whether the two parasites are identical. Leidy's description, which in a measure recalls the genus *Davainea*, reads as follows:

TÆNIA LATICEPHALA, Leidy. Head large; acetabula opposite, very prominent, large, hemispherical; mouth slightly prominent, unarmed. Neck short. Anterior segments of the body short, oblong square; posteriorly square. Generative apertures marginal, alternate. Protruding penes, elongate conical. Length of one specimen 9 inches, greatest breadth $\frac{3}{4}$ of a line. Breadth of head $\frac{1}{2}$ a line; of neck $\frac{1}{4}$ a line.

Hab. The small intestine of *Hystrix dorsata*.

B. americana was described in the preliminary note to the present revision as an *Andrya*, but a comparison of Meyner's excellent anatomical description of *B. mucronata*, and of his cotype, with the form under discussion shows that the American species is more closely related to *B. mucronata* than to *A. rhopalocephala;* on this account *A. americana* is transferred in the present paper to the genus *Bertia*.

Several specimens of tapeworms were sent to the collection of the

Bureau of Animal Industry by Professor Elrod, of Bloomington, Illinois, with the following label: "From Mesenteries of Canada Porcupine. Snake River,[1] near Nat. Park, Aug., 1894, M. J. Elrod."

The following specific description will easily allow the recognition of the form:

Diagnosis.—*Bertia americana* (Stiles, 1895), Stiles, 1896: Strobila attains 33 mm. in length by 6 mm. in breadth and contains about 90 segments, the oldest of which are 0.8 mm. long. In some specimens the posterior segments become much narrower, longer, and thicker than the middle segments. Head, unarmed, measures 0.6 mm. broad by 0.38 mm. long by 0.32 mm. thick, and is nearly rectangular in apex view. The neck is absent, and the head is frequently retracted into the body, as in *Drepanidotænia laceolata*. Suckers round, 0.176 mm. in diameter, open anteriorly. Genital anlagen visible in the earliest segments. Genital pores alternate in posterior half of margin. Male organs: Testicles form a continuous band in the distal portion of the median field, extending on both sides to the longitudinal canals; about seventy testicles to a segment; vas deferens runs in the proximal portion of the segment; cirrus-pouch lies dorsal of the vagina, is very muscular, 0.48 mm. long by 0.144 mm. broad and extends to the ventral canal; it contains a vesicula seminalis (0.19 mm. long) in its proximal portion, and the rather short, retracted, spinous cirrus in its distal portion. Female organs: The anlagen of the glands are seen immediately back of the head in or near the median line ventral of the testicles; at first the glands are but little differentiated, but on their pore side a globular receptaculum seminis rapidly develops and becomes filled with spermatozoa; the glands develop rapidly, coming to lie right and left of the median line, the ovary becoming quite broad. The development of the uterus could not be followed in detail, but eventually it occupies the entire median field and becomes filled with ova 40 μ in diameter; bulb of pyriform body 16 to 18 μ. Excretory and nervous systems:[2] Dorsal canals lie lateral of ventral canals and possess a thin lining. Genital canals cross the longitudinal canals and nerves dorsally. Calcareous corpuscles absent.

Hosts.—Yellow-haired Porcupine (*Erethizon epixanthus*), by Elrod; Canada Porcupine (*E. dorsatus*), by A. K. Fisher.[3]

[1] The Canada Porcupine (*Erethizon dorsatus*) does not extend so far west; the host must have been the yellow-haired Porcupine (*E. epixanthus*).

[2] The excretory system of this form will repay a careful study; in several anterior segments (transverse sections) I found the dorsal canals connected with the transverse canals, see pl. x, fig. 8.

[3] Since finishing this paper I have found some specimens in the Bureau of Animal Industry collection (No. 1502) which agree with Elrod's specimens, and bear the label, "*E. dorsatus.*" These specimens were collected by Dr. A. K. Fisher at Lake George, New York. Fisher states that nearly every porcupine he has examined harbors this worm.

Cobbold, in 1862, examined some parasites from the same host-species and determined them as "*Tænia pectinata,*" with pores "all on one side."

Types.—Bureau of Animal Industry Cestode Series No. 1349 designated as type, and deposited with sections of paratypes (Nos. 1350–1352) in United States National Museum. Paratypes distributed as follows: *America:* Collection of Bureau of Animal Industry; collection of Stiles (U.S.N.M.); collection of Hassall; collection of M. J. Elrod (Bloomington, Illinois). *Europe:* Berlin Museum; Vienna Museum; collection of Blanchard; British (South Kensington) Museum (London).

Geographical distribution.—North America (Wyoming, by Elrod, and Lake George, New York, by Fisher).

BERTIA AMERICANA LEPORIS (Stiles, 1895), Stiles, 1896.

(Plate X, figs. 11–15.)

1895, *Andrya americana leporis*, STILES, Vet. Mag., II, June, p. 344. Aug. 28, 1895.

Of this form I have but five specimens, all in exceedingly poor condition and unfit for any histological observations or detailed anatomical study. Enough can be seen on the preparations, however, to give a diagnosis which distinctly separates the parasites from all the other forms found in rabbits.

The specimens were collected by Cooper Curtice; when they came into my possession there was nothing upon the label to give any clue to their origin, other than that Curtice collected them from *Lepus*.

The specimens (Bureau of Animal Industry, Cestode Series Nos. 1170–1172, 1175–1176), all mounted, measure 23 to 47 mm. long, the widest segments attaining 5 to 6.5 mm. in breadth. Due allowance must here be made for the contraction of the specimens and the fact that they were subjected to pressure in mounting.

The head is present on all specimens, and varies in measurement, as shown in the following table:

Measurements of heads of Bertia americana leporis.

No. (U. S. N. M.).	Breadth.	Length.
	mm.	*mm.*
1170	0.610	0.504
1171	.656	.448
1172	.656	(?)
1175	.688	(?)
1176	.640	.672

The form of the head can not be taken as a character of value, as it varies according to contraction. Plate X, figs. 12–13, show the heads of Nos. 1170 and 1176, U. S. N. M. Rostellum could not be distinguished. The four suckers are powerful, and open diagonally forward; they are unarmed in the specimens at hand; their diameter varies between 0.22 and 0.24 mm., the muscular wall measuring about 64 μ thick. There is no neck present, the segments being perfectly distinct immediately back of the head.

The number of segments in the different specimens varies from about

60 to 95, but in no case was the strobila complete, as all of them had evidently shed proglottids. In some cases the head was retracted into the anterior segments, as is described for *Drepanidotænia lanceolata*. In only one specimen (Plate X, fig. 13) was it extended. The first segment could not be satisfactorily measured; the second segment (No. 1176, U.S.N.M.) measured 0.448 mm. broad (slightly narrower than the head) by 64 μ long, and showed no trace of genital organs. The cirrus was distinctly visible in one specimen in the sixth segment, but no positive statement can be made for the earlier proglottids. In some of the other specimens the cirrus did not appear until several segments later—in the eleventh in one case. The poor condition of the material must, however, be taken into consideration in this connection.

Several segments after the appearance of the cirrus, a roundish body about 16 μ in diameter appears in each proglottid, alternating a very short distance to the right and left of the median line. This body, which develops first from the eighth to the fourteenth segment, evidently represents the receptaculum seminis. In each succeeding segment it is slightly farther from the median line than in the segment immediately preceding, so that we may conclude that the median line of the cestrode strobila is the seat of very active growth, a conclusion supported by observations on other species also, more particularly on the early genital anlagen of *Thysanosoma giardi*.[1] The testicles soon appear and extend in an irregular line across the median field of the segment, for the greater part distally of the female anlagen; their number could not be ascertained exactly because of the poor condition of the material, but, as nearly as could be estimated from various portions of segments which were in better condition, there are about 50 testicles to each proglottid.

The genital pores are alternate and situated in about the middle of the lateral margin; the genital cloaca is generally quite deep. The cirrus and cirrus pouch are quite characteristic and allow an immediate determination of the form. The cirrus pouch assumes various shapes and proportions according to its contraction, but in general may be described as pyriform; it measures about 0.4 mm. long by 0.16 mm. broad; its proximal portion (0.192 to 0.224 mm.) is extremely muscular, being provided with an inner circular layer and an outer longitudinal layer, the two together, in some cases, measuring 16 μ thick. The cirrus extrudes from the pouch in the majority of the segments; when retracted, it appears spinous (wrinkles of the cuticle?) but extruded it is evidently smooth; the largest cirrus observed was 0.24 mm. long by 32 μ thick. The continuation of the cirrus canal in the proximal portion of the pouch is swollen into a vesicula seminalis and from the proximal extremity of the pouch the rather prominent vas deferens extends, somewhat sinuously, through the anterior portion of the pore side of the segment to

[1] A Revision of the adult cestodes of Cattle, Sheep, and allied animals; Bull. 4 Bureau of Animal Industry, p. 63, pl. XII, fig. 3.

the vicinity of the female anlage—farther than this it could not be traced. The female organs gradually undergo a change, but this process can not be described in detail because of lack of proper material. All that it is at present safe to say is that a dark body of cells arises in the vicinity of the receptaculum seminis and develops into the female glands very similar to those found in the *Bertia* of the porcupine; the uterus gradually extends over the segment suppressing the genital glands.

Eggs globular with three membranes, but pyriform body not visible; outer membrane 40 to 42 μ in diameter; middle membrane could not be studied; inner membrane immediately surrounding the oncosphere 21 μ in diameter; hooks of oncosphere 9 μ long. Numerous small calcareous corpuscles present in the parenchyma.

This worm has an entirely different appearance from the one found in the porcupine and it is possible that it will eventually be raised to specific rank. My material, however, does not warrant such a step at present.

The following is proposed as a diagnosis of the variety:

Diagnosis.— *Bertia americana leporis* (Stiles, 1895), Stiles, 1896: Strobila 23 to 47 mm. long by 5 to 6.5 mm. broad, possessing from 60 to 95 segments. Head about 0.6 mm. broad by 0.4 to 0.6 mm. long, unarmed; suckers large, about 0.2 mm. in diameter, unarmed. Neck absent, stobilization beginning immediately back of the head. Genital pores alternate, situated in about the middle of the lateral margin. Genital organs develop very early, the male organs being visible sometimes as early as the sixth segment. Cirrus large and (?) smooth. Cirrus pouch about 0.4 mm. long by 0.16 mm. broad; its proximal portion is very muscular and contains a vesicula seminalis. Vas deferens, large and prominent, extends from the region of the female glands to the cirrus pouch in the proximal portion of the segment; testicles for the greater part in the distal portion of the segment, about 50 in number, arranged in an irregular row across the median field. Female glands first appear in the eighth to fourteenth segment alternately right and left of the median line; uterus spreads from female glands and occupies entire median field; ova globular with three thin membranes; pyriform body apparently not present; outer membrane 40 to 42 μ in diameter; middle membrane?; inner membrane 21 μ in diameter; hooks of oncosphere 9 μ long. Calcareous corpuscles present.

Host.—Lepus, sp. ?, by Curtice, development unknown.

Types.—Description based upon five specimens, of which Bureau of Animal Industry Cestode Series No. 1171 is designated as *Type* and deposited in the United States National Museum; paratypes Nos. 1170, 1172, 1175, 1176 U.S.N.M.

Original material poorly preserved, alcohol (?) method, stained with hæmatoxylin.

Geographical distribution.—United States of North America (State?) by Curtice.

Genus CITTOTÆNIA, Riehm, 1881.

1881, *Cittotænia*, RIEHM, Zeitschr. f. d. ges. Naturwiss., 3 ser., VI, p. 200. Type, *Cittotænia latissima* Riehm, 1881 = *Tænia denticulata* Rudolphi, 1804.

1881, "*Dipylidium*, LEUCKART," 1863, p. p. of RIEHM, Zeitschr. f. d. ges. Naturwiss., 3 ser., VI., p. 200; p. 565. Type, *Tænia canina* Linnæus, 1758.

1891, *Moniezia* p. p., R. BLANCHARD, Mém. Soc. zool. France, IV, p. 187; p. 444. Type, *Tænia expansa* Rudolphi, 1810.

1893, *Ctenotænia*, RAILLIET, Traité Zool. méd. et agric., I, p. 278. Type, *Tænia marmotæ*, Frölich, 1802.

Diagnosis.—*Cittotænia*, Riehm, 1881: Anoplocephalinæ with segments broader than long and longer than thick; end segments in some cases showing a tendency to become longer and narrower. Two full sets of genital glands and two lateral genital pores to each segment; generally one, in some cases two, simple transverse tubular uteri in each segment; uterus generally possesses simple proximal and distal diverticula. The vagina is ventral of the cirrus pouch on both sides of the segment. Dorsal canal varies somewhat in position, but shows a constant tendency to lie between the ventral canal and nerve, especially at the plane of the genital pores. Genital canals cross the longitudinal canals and nerves dorsally. Interproglottidal glands absent. Calcareous bodies not yet recorded. Eggs with well-developed pyriform body, the horns of which are long, generally filamentous, crossing each other.

Hosts.—Rodents.

Type.—*Cittotænia latissima*, Riehm, 1881, = *Cittotænia denticulata* (Rudolphi, 1804), Stiles & Hassall, 1896.

Riehm proposed the genus *Cittotænia* in 1881, with *C. latissima* as type and only species; his description reads as follows:

4. *Cittotænia latissima.* Die Gattung ist errichtet mit Rücksicht auf die merkwürdige Ausbildung des Excretionsorganes, welches nicht leiterartig, sondern mit je 3–5 vielfach anastomosirenden und in einander übergehenden Hauptseitenstämmen und zahlreichen, das ganze Thier netz-förmig durchsetzenden Nebenästen, rankenartig die Tänie durchzieht. C. latissima hat doppelte Geschlechtsorgane, welche auf den zizzenartig vorspringenden Hinterecken der Glieder nach aussen münden. Der Kopf breiter als bei den vorigen erscheint vorn abgestutzt, hakenlos. Länge der Strobila bis 2½ Fuss, Breite der letzten Proglothiden bis über ¾ Zoll. Wohnthier: Kaninchen.

In the same paper Riehm placed two other double-pored anoplocephaline cestodes in Leuckart's genus *Dipylidium*, i. e., *D. pectinatum* and *D. leuckarti*, and later in the same year[1] he rejected his newly established genus *Cittotænia*, uniting it with *Dipylidium*.

In 1891 Blanchard[2] united in the genus *Moniezia* the double-pored anoplocephaline cestodes of rodents with those of ruminants. In 1893

[1] Studien an Cestoden. Zeitschr. f. d. ges. Naturwiss., 3 ser., VI, 1881, pp. 565, 580.
[2] Mém. Soc. zool. France, IV, 1891, p. 187.

Stiles[1] excluded the known parasites of rodents from the genus *Moniezia*, while Railliet proposed for the double-pored leporine forms the genus *Ctenotænia* with *Tænia marmotæ* as type.

At first thought this genus does not appeal to helminthologists, who have not paid special attention to the Anoplocephalinæ, as being well founded, but an anatomical study of the various forms does, I believe, fully justify the separation of the double-pored cestodes of rodents from the double-pored forms found in ruminants. The generic term *Cittotænia* having priority must of course be accepted in preference to *Ctenotænia*.

The characters of the three genera of double-pored anoplocephaline forms, according to my present interpretation, are as follows:

Diagnosis.—Moniezia, R. Blanchard, 1891: Anoplocephalinæ with segments generally broader than long and longer than thick; end segments showing a tendency to become longer and narrower. Two full sets of genital organs, with two (very complex) reticulate uteri and two lateral pores in each segment. On the right side the vagina is ventral, cirrus dorsal; on the left side vagina dorsal, cirrus ventral. Dorsal canal lies dorso-median of ventral canal. Genital canals cross the longitudinal canals and nerves dorsally. Interproglottidal glands generally present. Calcareous corpuscles absent from parenchyma. Eggs with well developed pyriform body, the horns of which generally (always ?) end in a disk.

Hosts.—Ruminants.

Type.—Moniezia expansa (Rudolphi, 1810), R. Blanchard, 1891.

For diagnosis of *Cittotænia*, see above, p. 170.

Diagnosis.—Thysanosoma, Diesing, 1835: Anoplocephalinæ with segments generally broader than long and longer than thick; end segments show a tendency to become longer and narrower. Two sets or one set of genital glands and two lateral genital pores, or one lateral genital pore to each segment; one transverse undulating uterus with ascon-spore or cornucopia-like egg-pouches. Genital canals cross the ventral canal and nerve dorsally, the dorsal canal ventrally. Interproglottidal glands absent. Calcareous bodies absent from the parenchyma. Horns of pyriform body absent.

Hosts.—Ruminants.

Type.—Thysanosoma actinioides, Diesing, 1835.

From this analysis of characters it will be seen that *Cittotænia* forms an excellent intermediate genus between *Moniezia* and *Thysanosoma*.

The genus may be divided into two groups: *Marmotæ* or *Denticulata Group* and *Pectinata Group*, the division being based upon the form of the cirrus pouch. In the first group this organ is pyriform, distinct and very muscular; in the second group it is more elongated, resembling the nozzle to a hose, and is less distinct.

[1] Centralbl. f. Bakteriol. u. Parasitenk., XIII, 1893, p. 457; also, Bull. 4, Bureau Animal Industry, 1893, p. 54.

MARMOTÆ OR DENTICULATA GROUP.

CITTOTÆNIA MARMOTÆ (Frölich, 1802) Stiles & Hassall, 1896.

(Plate XI, figs. 1–8; Plate XII, figs. 1–2.)

1802, *Tænia marmotæ*, FRÖLICH, Der Naturforscher, XXIX, p. 77–79, pl. II, fig. 17–20.
1891, *Moniezia marmotæ* (FRÖLICH, 1802), R. BLANCHARD, Mém. Soc. zool. France, IV, p. 187; pp. 444, 461–467, figs. 31–35.
1893, *Ctenotænia marmotæ* (FRÖLICH, 1802), RAILLIET, Traité d. Zool. méd. et agric., I, p. 278.
1896, *Cittotænia marmotæ* (FRÖLICH, 1802) STILES & HASSALL, Veterinary Magazine, III, p. 407.

Gœze[1] in 1782 examined a worm which Blumenbach had collected from the Marmot; this parasite, which was probably *Cittotænia marmotæ*, Gœze considered identical with his *Tænia pectinata*.

Frölich[2] in 1802 found a cestode in the intestine of the Marmot (*Arctomys marmota*) and described it under the name *Tænia marmotæ*, as follows:

[p. 77.] 43: *Taenia Marmotae* oblonga lanceolata antice attenuata utrimque serrata, articulis brevissimis, medio utrimque poro pilifero notatis, capite mutico. Tab. II, f. 17–20.

MURMELTHIER-BANDWURM.

Die Länge dieser Würmer ist sehr veränderlich. Die grössten Individuen hatten 6–7 Zoll in der Länge, ungefähr 11‴ in der Breite am Hintertheile, und beinahe 1‴ in der Dicke. Ihre Gestalt ist überhaupt lanzettförmig, in die Länge gezogen, am Vordertheile allmälig, aber sehr beträchtlich, verschmälert, so dass das Vorderende am Grunde des Halses kaum etwas über 1‴ breit ist. Aeltere Würmer, die durch Geburten schon mehrere Glieder abgesetzt haben, sind am Hinterende am breitesten, abgestutzt, oder halbmondförmig ausgerandet; jüngere Würmer, die noch nicht gebohren haben, werden am Hinterende etwas schmächtiger, und das letzte Glied ist abgerundet.

Der Kopf ist verhältnissmässig sehr klein, rundlich, rüssellos, unbewaffnet, hellweiss, mit vier deutlichen Saugblasen, die gepaart über einanderstehen; [p. 78] an der Spitze ein undeutliches Knötchen, statt des Rüssels.

Der Hals ist zusammengedrückt rundlich, sehr schmächtig, etwas länger als der Kopf, gliederlos, abwärts breiter, und unvermerkt in den Vorderkörper übergehend.

Das Vorderende des Körpers scheint da, wo es an den Hals grenzet, fast gliederlos, wird von da abwärts sanft und unvermerkt breiter, und die Glieder, die vorwärts nur durch Querstreifen angezeigt waren, entwickeln sich da deutlicher.

Die Glieder des Körpers sind ganz sichtbar ineinander geschoben, wenigstens 20 mal breiter als lang, gleichbreit, dicklich, perlenweiss, zu beiden Seiten in einen scharfen, hervorragenden Zahn auslaufend, in der Mitte der Oberfläche eine eingedrückte Längslinie. Jedes Glied hat in der Mitte des Seitenrandes ein dunkleres, hervorragendes, wulstiges, in der Mitte durchbohrtes Knötchen, aus welchem ein haarfeiner, geradegestreckter, schneeweisser, über 1‴ langer Borsten hervorragt. Diese Seitenborsten sind nicht immer sichtbar, sondern sehr oft in den Rand der Glieder zurückgezogen, wo sie denn an jeder Seite des Gliedes eine hellere Querlinie bilden. Die hintern Glieder nehmen an Breite und Länge etwas zu.

[1] Versuch einer Naturg. der Eingeweidewürmer thierischer Körper, Blankenburg, p. 363, footnote.

[2] Beiträge zur Nat. der Eingeweidew., Der Naturforscher, XXIX, 1802, Halle, p. 77.

Wohnort: In den dünnen Gedärmen des Murmelthiers (*Arctomys marmota* Schreb.).

Anm. Ich traf diese schöne Wurmart in dem genannten Thiere, das in den allgauischen Alpen einheimisch ist, und von dem ich ein paar Stücke am 28 Julius 1797 zu untersuchen Gelegenheit bekam, in ausserordentlicher Menge an. In den Gedärmen eines ältern Murmelthiers fand ich ganze Nester von diesen Würmern, so dass ihre Zahl, im Ganzen genommen, über 50 Stücke betragen haben muss. Es lagen ihrer manchmal 5-7 beysammen, und dehnten den Darmkanal, indem sie in Knaulen übereinander lagen, ungemein aus.

Ich sah Stücke von diesen Würmern, deren hintere Glieder in der Mitte durchlöchert waren; andere Individuen hatten sich am Hintertheile durch die Schlinge geschoben.

Man sieht von selbst, dass die gegenwärtige Art mit dem lanzetförmigen Bandwurme[1] ungemein viele Aehnlichkeit habe, da auch dieser an den Rändern der Glieder kurze Seitenborsten zu haben pflegt; demungeachtet kann ich mich bey genauer Vergleichung nicht überzeugen, dass beide Würmer einerley Art seyn. Auch die *Tænia pectinata*[2] ist mit dieser Art nahe verwandt.

Rudolphi[3] in 1814 and 1819, Diesing[4] in 1850, and Baird[5] in 1853, mention Frölich's parasite under *Tænia pectinata*, accepting *Tænia marmotæ* as synonym. R. Blanchard[6] in 1891 was evidently the second zoologist to find this species; he found 214 worms in four marmots at Briançon, in September, 1887. The specimens attained 112 mm. in length by 5 to 13 mm. in breadth. Head measured 0.55 to 0.63 mm. long by 0.80 to 0.84 mm. broad; suckers globular, 120 μ in diameter; neck absent; segments varied from 56 μ to 0.75 mm. in length; genital pores double and opposite, in posterior half of lateral margin. Blanchard described a subcuticular excretory system, with two lateral longitudinal canals, connected by a transverse canal with the canals of the opposite side. Ova measured 48 to 60 μ; bulb of pyriform body, 23 μ.

Stiles[7] in 1893 found that the dorsal canal lies between the ventral canal and nerve, and that the genital canals run dorsally of the longitudinal canals and nerves. He was unable to find Blanchard's accessory excretory system. Later he[8] figured the genital organs.

Railliet[9] in 1893 took this species as type of his new genus *Ctenotænia*.

From writings of Frölich and Blanchard and from my own studies I propose the following as revised specific diagnosis:

Diagnosis.—Cittotænia marmotæ (Frölich, 1802), Stiles & Hassall, 1896: Strobila attains 112 mm. (perhaps more) in length by 5 to 13 mm. in breadth. Head, 0.8 mm. broad by 0.5 to 0.6 mm. long; hooks absent;

[1] Goeze, Eingeweidew., p. 377, pl. XXIX, fig. 3–12.

[2] Ebendas, p. 363, pl. XXVII, fig. 7–12.

[3] Erster Nachtrag, etc., Ges. Naturf. Freunde Berlin, etc., VI, 1814, p. 108; Entozoorum Synopsis, 1819, p. 488.

[4] Systema helminthum, I, p. 498.

[5] Cat. Specs. Entozoa or Intestinal Worms, Coll. Brit. Mus., p. 78.

[6] Mém. Soc. zool. France, IV, pp. 444, 461–466, figs. 31–35.

[7] Cent. f. Bakt. u. Paras., XIII, pp. 449–450, fig. 9.

[8] Stiles & Hassall, 1893, Bull. 4, Bureau of Animal Industry, p. 71, pl. VII, figs. 6–7.

[9] Traité de Zool. méd. et agric., I, p. 278.

rostellum not visible. Neck absent, segmentation beginning immediately back of the head, the proglottids rapidly becoming distinct; segments vary in length from 56 μ to 0.75 mm., and are always much broader than long, measuring in some cases 13 mm. broad; the posterior flap projects but a short distance over the anterior border of the next following segment. Genital pores double and opposite in posterior half of lateral margin. Genital cloaca quite deep. Anlagen of genital canals and female glands visible in the first segments, testicles appear a little later. Male organs: Testicles appear about the thirtieth segment, between 100 and 150 in number to a proglottid, scattered through the median field between the ovaries; cirrus-pouch, 0.5 mm. long by 0.17 mm. broad, very muscular, with vesicula seminalis in proximal portion and coiled smooth penis in distal portion. Female organs: Female glands nearly 1 mm. from the lateral border of the segment, some distance from the longitudinal canals; ovarian tubules appear about the thirty-fifth segment, reach their highest development from the forty-seventh to fifty-seventh segments and then rapidly atrophy, disappearing almost entirely by the sixtieth segment; vagina ventral of the cirrus-pouch on both sides of the segment; uterus single, transverse, proximal to testicles, and possesses proximal and distal blind pouches, similar to those of *Cittotænia pectinata*. Ova, 48 to 60 μ; bulb of pyriform body, 23 μ. Excretory system: Dorsal canal between ventral canal and nerve. Longitudinal nerves rather close to lateral margin, near distal end of cirrus-pouch. Genital canals cross the longitudinal canals and nerve dorsally.

Host.—Marmot (*Arctomys marmota*) by Frölich and Blanchard.

Types.—Original type (?). Typical specimens with R. Blanchard (Paris), collection Bureau of Animal Industry (No. 1370, B.A.I.), and collection of Stiles (U.S.N.M.).

Geographical distribution.—(?) Frölich; France (Briançon), by Blanchard.

CITTOTÆNIA DENTICULATA (Rudolphi, 1804), Stiles & Hassall, 1896.

(Plate XII, figs. 3–8; Plate XIII, figs. 1–3.)

1804, *Tænia denticulata*, RUDOLPHI, Bemerkungen a. d. Gebiete d. Naturg., etc., p. 81.

1828, *Alyselminthus denticulatus* (RUDOLPHI, 1802), DE BLAINVILLE, Dict. d. Sci. nat., LVII, p. 607.

1853, *Tænia goezei*, BAIRD, Cat. Entozoa Coll. British Museum, p. 78.

1881, *Cittotænia latissima*, Reilm, Zeitschr, f. d. ges. Naturw., 3 ser., VI, p. 200.

1881, *Dipylidium latissimum* (Riehm, 1881), RIEHM, Zeitschr. f. d. ges. Naturwiss., 3 ser., VI, pp. 583–590, pl. v, figs. 5, 15, 17; VI, fig. 2.

1887, *Tænia latissima* (RIEHM, 1881), NEUMANN, Traité des maladies parasitaires non-microbiennes, p. 426.

1891, *Moniezia denticula* [*ta*] (RUDOLPHI, 1804), R. BLANCHARD, Mém. Soc. zool. France, IV, p. 187.

1891, *Moniezia latissima* (RIEHM, 1881), R. BLANCHARD, Mém. Soc. zool. France, IV, pp. 187, 451.

1891, *Moniezia goezei* (BAIRD, 1853), R. BLANCHARD, Mém. Soc. zool. France, IV, pp. 444, 452–457, figs. 21–25.

1893, *Ctenotænia goezci* (BAIRD, 1853), RAILLIET, Traité d. Zool. méd. et agric., I, p. 278.
1896, *Ctenotænia denticulata* (RUDOLPHI, 1804), STILES & HASSALL, Vet. Mag., III, p. 6-9, and Centralbl. f. Bakt., Parasitenk. u. Infektionskrankh., Erste Abt., XIX, 70-72.
1896, *Cittotænia denticulata* (Rudolphi, 1804), Stiles & Hassall, Vet. Mag., III, p. 407.

This species has had a most curious history, which should be a demonstration to every helminthologist not yet convinced that in determining a cestode the microscope—not the yardstick—is his most important instrument, and that internal topographical anatomy—not conditions of contraction of the external form—furnishes the important characters for classification.

At present we may be said to have two extreme parties in helminthological work; one party apparently considers minute histological details as all-important, and looks down upon the systematic work, especially that class of systematic work which studies into the bibliographic history of the species and demands a consistent application of the international rules of nomenclature; a second party appears to conceive the highest helminthology as consisting of determining and describing species chiefly upon external form, looking upon histological and anatomical details as "of interest to those who are interested in such matters," but of no importance to science. The history of *C. denticulata* should, however, convince everyone that there is a middle ground upon which we should all unite, namely: First, careful determination and description of worms upon internal topographical anatomy; secondly, a thorough study of the history (both life history and bibliographic history) of each species; thirdly, histological details, and fourthly, a consistent application of such rules of nomenclature as will render all of our work international: International Rules.

Rudolphi[1] in 1804 originally described *Tænia denticulata* as follows:

Unter den Eingeweidewürmer [*i. e.*, in the Hanover collection] war ein Stück, das mich sehr interessirte, nämlich ein Bandwurm, der in Havemanns Gegenwart einem Kalbe abgegangen war; er war aber ohne Kopf."

"Ich habe diese Würmer im Museum zu Alfort wieder gefunden, und auch einige Exemplare geschenkt bekommen. In seinem itzt ganz vergriffenen Werke über die Würmer hat Chabert ihn mit allen übrigen Bandwürmern, unter dem Namen Tenia rubnaé [rubané] zusammengeworfen; im Museum hingegen war der Bandwurm aus Darm und Magen der Kuh ohne Noth in zwey Arten getheilt. Es ist eine wirklich neue, noch nirgends beschriebene Art, die ich *Tænia denticulata* nenne, und an einem andern Ort ausführlich beschreiben werde. Der Wurm ist 5 bis 16 Linien lang, die vordern Glieder sind 2 bis 5 Linien, die hintern beynahe einen Zoll breit; der kleine viereckige Kopf unbewaffnet, mit vier in Kreuz stehenden Saugmündungen; kein Hals, alle Glieder kurz, mit Oeffnungen an beyden Seiten, aus denen mehrentheils ein kleiner spitzer Körper hervorsteht, wodurch der Wurm wie gezahnt erscheint. Ich selbst habe ihn nie beym Rindvieh gefunden.

Later,[2] in 1805, he adds:

14. *Tænia denticulata* mihi. T. rubanés et lancéolés dans les intestins d'une vache.

[1] Bemerkungen aus dem Gebiete der Naturgeschichte, Medizin und Thierarzneykunde auf einer Reise durch einen Theil von Deutschland, Holland und Frankreich, I, Berlin, p. 81.

[2] Bemerkungen, etc., II, p. 39.

Im Katalog steht: Deux espèces de Ténias rendues par la vache. Auf einem andern Glase steht: Ténias rubanés dans la caillette d'une vache. Ich muss aber alles für einerley halten, und habe schon von dem Wurm eine kurze Beschreibung gegeben wie ich von dem Kabinet der Thierarzneyschule in Hannover sprach.

Still later Rudolphi[1] in 1810 continues the parasite under the same name and discusses it more in detail. His entire remarks are quoted here, as they are important, being based upon the original material.[2]

[P. 79.] TAENIA DENTICULATA, R. Taenia: *capite tetragono, collo nullo, articulis brevissimis foraminibus marginalibus oppositis, lemniscis dentiformibus.*

[P. 80.] Camper in Beschäft. Berl. N. Fr., 4, p. 139.

Gmelin, Syst. Nat., p. 3074, n. 55, Taenia ovina *β.* bovis.

Carlisle Transact. Soc. Linn. II, tab. 25, fig. 15, 16. Taenia ovina, bovis.

Rudolphi Isodoepor, Vol. I, p. 81; Vol. II, p. 39. Taenia denticulata.

Hab. in *Bove.* Camperus .. bove; Havemannus, Scholae Vet. Hannov. Director meritissimus, a vitulo (solitariam, capite destitutam); Chabertus a vacca copiose, dejectam observaverunt, hic etiam in vaccae ventriculo quarto reperit. Specimina mea ex Museo Scholae Veterinariae Altorfensis ditissimo.

Descr. Vermes quindecim ad sedecim pollices longi, antice duas ad quinque lineas, postice fere pollicem lati; coloris albidi, vel grisei.

Caput exiguum, tetragonum, latiusculum, *osculis* quatuor, anticis, subcontiguis, subglobosis, horum apertura exigua, orbiculari. *Collum* nullum. *Articuli* aliquot capiti proximi angusti, mox vero latiores, tandem latissimi et subaequales fiunt, ita tamen, ut in uno alterove specimine media vermis pars paullo angustiores et simul longiores objiciat; omnes ceteroquin brevissimi, ut longitudo latissimorum vix lineam, plurimorum ne dimidiam quidem excedat. Margines articulorum postici crenati sive undulati superficiem insequentium qua partem tegunt; laterales (anterioribus nonnullis, rarius mediis quibusdam articulis exceptis) obtusiusculi [p. 81], foramine utrinque medio, opposito, insignes, e quo denticulus acutus, leviter reflexus et duriusculus (lemniscus) exseritur. Substantia mollis, plus minus crassiuscula, ut crassities interdum lineam adaequet. *Ova* in substantia media cumulata, ovariis regularibus mihi non visis.

Obs. 1. Carlisle in figuris citatis canales articulorum laterales longitudinem versus decurrentes et ovaria in racemum brevissimum et latissimum digesta, habet; haec omnia ne in tenuioribus quidem speciminibus vidi, vel sectione detegere potui. Denticuli validi horumque foramina ab eodem minus bene sistuntur.

Obs. 2. Chabertus in opere Bibl. n. 199.[3] indicato Taeniam hancce cum reliquorum mammalium Taeniis, sub nomine Ténia rubané, perperam conjunxit, in Musei Alfortensis autem catalogo duas in species (Ténia rubané et Ténia lancéolé) praeter ullam necessitatem divisit, nam specimina minora quam reliqua ad formam lanceolatam magis accedere nil refert.

Obs. 3. A specie praecedente notis in obs. 2. ad eandem indicatis abunde differt quibus autem Taenia caprae n. 84. dicta distinguenda sit, hujus capite non viso determinare non ausim; pars antica tamen quam in denticulata tenuior, licet quam in praecedente latior, videtur.

That the citations from Camper, Carlisle, and Gmelin must be rejected from the bibliography of this species follows from the data given on page 177.

[1] Entozoorum sive vermium intestinalium. Historia naturalis, II, pt. 2, p. 39.

[2] The original description of 1804 is evidently based upon the Alfort material and not upon the specimen seen at Hanover. Chabert's specimens must therefore be taken as types.

[3] Traité des maladies vermineuses dans les animaux. Paris, 1782; second edition, 1787; German translation, Göttingen, 1789.

Gurlt[1] in 1831 obtained Rudolphi's specimens and gave two figures of the worm. Creplin[2] in 1842 also studied the originals and gave quite a fair description of them (for details see Stiles[3]).

Since Creplin's time numerous authors have mentioned *T. denticulata* as a parasite of cattle and sheep, and quite a number of specimens have been determined as belonging to this species (for details see Stiles[3]). In 1891 Blanchard[5] placed this species in his genus *Moniezia*. Later,[6] in 1893, I studied several end segments of Rudolphi's originals, compared them with several specimens determined as *T. denticulata* by various helminthologists, and called attention to the disagreement in the statements of different authors as well as to the fact that none of their specimens agreed with Rudolphi's original type. The few statements I made upon the originals were extremely meagre and guarded, showing that "we know practically nothing of the microscopic anatomy of *M. denticulata*."

Upon examining originals of Baird's *Tænia goezei* and Riehm's *Dipylidium latissimum*, Hassall and Stiles were surprised to find the great resemblance the cirrus bore to the cirrus in the few segments of Rudolphi's material deposited in the United States National Museum. Through the kindness of Geheimrath Möbius and Dr. A. Collin we obtained further material of Rudolphi's originals and were able to prove[7] that *Tænia denticulata* contained two distinct species of cestode, i.e., one agreeing with Riehm's *D. latissimum* and *T. goezei*, the other with *Ctenotænia pectinata* (Goeze, 1782 partim, Riehm, 1881), Railliet, 1893. We then expressed the opinion that an error had occurred in the original label of Rudolphi's specimens, and that they were in reality leporine rather than bovine cestodes.

Baird's description[8] of *T. goezei*, in 1853, reads as follows:

19. *Tænia Goezii*, Baird. Head wanting. Articulations of body very short, numerous. The inferior margin straight. Genital orifices opposite, situated on or near the lower edge of each joint, the lemniscus being projected out in form of an elevated papilla, which curves downward. Greatest breadth of body 6 lines, length of articulations about ¼ a line.

This species differs from *expansa* and *denticulata* in having the posterior border or edge of each joint smooth and rounded, instead of being crenulate or undulated, and having the genital orifices situated on the lower edge of the joint instead of in the middle.

Hab. (?)

From old collection.

[1] Lehrbuch der pathologischen Anatomie der Haussäugethiere, p. 381, pl. x, figs. 3–4.

[2] Endozoologische Beiträge, Weigmann's Arch. Naturg., I, pp. 315–327.

[3] Revision of adult Cestodes of cattle, sheep, and allied animals, Bull. 4, Bur. An. Ind., U. S. Dept. Agric., 1893, p. 44.

[4] Loc. cit., 1893, pp. 44–46.

[5] Mém. Soc. zool. France, IV, 1891, p. 187.

[6] Loc. cit., 1893, pp. 42–47.

[7] Vet. Mag., III, 1896, p. 6–9.

[8] Cat. Specs. Ent. or Intestinal Worms, Coll. Brit. Mus., Lond., p. 78.

Riehm[1] in 1881 studied the tapeworms of rabbits and hares, and in a preliminary account of his work described this same form as *Cittotænia latissima*, new genus, new species. Later[2] he placed this species in the genus *Dipylidium* with the following specific diagnosis:

Kopf hakenlos über ½ mm. breit, mit stark vorspringenden Saugnäpfen und dadurch gegen die lanzettförmig sich verbreiternde Gliederkette deutlich abgesetzt. Geschlechtsöffnungen beiderseits, in den zitzenartig vorspringenden Hinterecken der Glieder, welche den Rändern, besonders der contrahierten Thiere ein gefranztes Ansehen verleihen. Glieder stets viel kürzer als breit und namentlich nach den Seiten hin ungemein dick. Länge im gestreckten Zustande bis 80 cm., Breite der reifsten Glieder 15 mm. und darüber Wohnthier: *Lepus cuniculus*.

Of anatomical details he gives the following, which appear to me to be of importance:

Segments may attain 3 to 3.5 mm. in thickness; the strobila is generally found in the lower portion of the small intestines and is of a grayish to a reddish gray in color, something like *Bothriocephalus latus*. Black pigment on the suckers and genital pores. Suckers prominent; neck short. Genital anlagen appear very early. Male organs: Testicles very numerous, 0.115 mm. in diameter, scattered throughout dorsal portion of median field; cirrus pouch large, provided with three layers of mucles, two circular and one longitudinal layer, cirrus is generally protruded. Female organs: Vagina opens close to cirrus, and is quite thin; median to the longitudinal canals it swells into a receptaculum seminis; female glands essentially the same as in *Dipylidium pectinatum*, but situated very close to the longitudinal canals. The uterus is described "not as a simple tube, widened here and there, and running transversely through the segment, but it is broken up into two or three such tubes, which unite here and there, and thus cut the parenchyma up into islands. This structure is seen, however, only in segments without eggs. Through the pressure of the developing ova these tubes widen so that the islands of parenchyma are suppressed and the uterus then appears as a single tube." In some segments an extra (third) set of female glands was observed right or left of the median line. Excretory system very highly developed; in the younger segments it is composed of a network of canals, with one lateral canal which is especially large; transverse canal with numerous anastomoses present; as the genital organs develop, the canals of the median field become more or less suppressed, but three or four lateral canals persist each side and the transverse canals at the posterior margin become larger, so that the excretory system now bears more of a resemblance to that of *Dipylidium pectinatum;* the second canal system (dorsal canal) resembles that of *Dipylidium leuckarti*. (Abstract.)

Neumann[3] in 1888, places this worm in the genus *Tænia*.

Blanchard[4] in 1891 examined Baird's specimens and recognized them as identical with *D. latissimum*, Riehm. He also examined fresh specimens, which he describes in some detail.

Strobila measures 40 to 50 cm. long and contains about 210 segments; head, 0.8 mm. broad by 0.63 long. Neck absent, segments may attain 4 mm. in length by 15 in breadth. Genital pore appears about the seventy-eighth segment; in the older segmnets it is more distal than in the younger segments; egg is spherical 52 to 60 μ; bulb of pyriform body 16 to 24 μ, horns long and curved. (Abstract.)

[1] [Untersuchungen an den Bandwürmern der Hasen und Kaninchen, Zeitschr. ges. Naturw. 3 ser., VI, 1881, p. 200.

[2] Studien an Cestoden, Zeitschr. ges. Naturw., 3 ser., VI, 1881, pp. 583–590.

[3] Traité des maladies parasitaires, p. 426, Paris, 1888.

[4] Mém. Soc. zool. France, IV, 1891, pp. 444, 451, 452–457, figs. 21–25.

Railliet[1] in 1893 places Riehm's species in his genus *Ctenotænia*.

From the work of former authors and from my own observations upon the original material of *T. denticulata*, *T. goezei*, and *Cittotænia latissima*, I propose the following as a revised specific diagnosis:

Diagnosis.—*Cittotænia denticulata* (Rudolphi, 1804), Stiles and Hassall, 1896: Strobila attains 40 to 50 cm., even 80 cm. in length by 15 mm. in breadth by 3.5 mm. in thickness, is grayish to grayish red in color, and is made up of 200 or more segments. Head unarmed, 0.8 mm. broad by 0.63 mm. long, suckers large and prominent; rostellum not observed. Neck absent. Genital pores double, prominent, opposite in posterior half of margin, near corner of the segment. Male organs: Testicles 0.115 mm. in diameter, very numerous, scattered through the dorsal portion of the median field; cirrus-pouch large and prominent, 1.12 mm. long by 0.32 mm. broad. Female organs: Vagina runs ventrally and distally of cirrus-pouch on both sides of segment; female glands very similar to those of *Cittotænia pectinata*, situated close to longitudinal canals; uterus very complex. Eggs 52 to 60 μ in diameter; bulb of pyriform body 16 to 24 μ. Excretory system: Very complex, numerous, thin-walled longitudinal canals (probably all belonging to the ventral system); dorsal canals with thick wall. Genital canals cross the longitudinal canals and nerves dorsally.

Host.—Common European wild rabbit (*Lepus cuniculus*).

Types.—Rudolphi's type in Berlin Museum; fragments in the collection of Stiles, Nos. 17, 1492, U.S.N.M. Baird's type in South Kensington Museum (London); fragments in collection of Blanchard. Riehm's cotypes in collection of Leuckart; Vienna Museum; No. 1328, U.S.N.M. Several typical specimens in collection of Moniez.

Geographical distribution.—Europe: France (Chabert, R. Blanchard, Moniez); Saxony (Riehm).

CITTOTÆNIA CTENOIDES (Railliet, 1890), Stiles, 1896.

(Plate XIV, figs. 1–8.)

1881, *Dipylidium leuckarti*, RIEHM, Zeitschr. f. d. ges. Naturw., 3 ser., VI, p. 200; pp. 566–577, pls. V, figs. 3, 11–13, 16; VI, figs. 5–6.

1888, *Tænia leuckarti* (RIEHM, 1881), NEUMANN, Traité des maladies parasitaires, etc., p. 126 [nec *Tænia leuckarti*, KRABBE, 1869, Bidrag, p. 335].

1890, *T. ctenoides*, RAILLIET, Rev. d. Sci. nat. appliq. Bull. Soc. nat. d'Acclimat. de France, p. 346.

1891, *Moniezia leuckarti* (RIEHM, 1881), R. BLANCHARD, Mém. Soc. zool., France, IV, p. 187; pp. 444, 450–451.

1893, *Ctenotænia leuckarti* (RIEHM, 1881), RAILLIET, Traité de Zool. méd. et agric., I, p. 278.

1896, *Cittotænia leuckarti* (RIEHM, 1881), STILES & HASSALL, Veterinary Magazine, III, p. 407.

For the history of this species prior to Riehm, 1881, see the historical review of *C. pectinata*, p. 184.

[1] Traité Zool. méd. et agric., I, p. 278.

Riehm[1] in 1881 was the first to clearly define this form, which he named *Dipylidium leuckarti*, with the following specific diagnosis:

Kopf hakenlos, sehr klein, etwa 0.5 mm. breit, mit 4 flachaufliegenden Saugnäpfen, nicht abgesetzt gegen den Hals, welcher mit lanzettförmiger Verbreiterung in die Gliederkette übergeht. Geschlechtsöffnungen beiderseits im hinteren Viertheil des Proglottisrandes. Glieder trapezförmig, auch im gestrecktesten Zustande noch breit, für gewöhnlich aber etwa 3-6 mal breiter als lang. Länge im gestreckten Zustande bis 80 cm., Breite der reifsten Glieder bis 1 cm. Die Strobila häufig durch Längsfalten der Haut wie gestreift. Wohnthier: *Lepus cuniculus*.

In the anatomical discussion, and in his figures, Riehm brings out the following points:

The head measures 0.5 mm. broad by about 0.166 mm. thick; neck moderately long, its distal end nearly twice as broad as its proximal end; 500 to 750 proglottids present in the strobila; posterior edge of segments extends prominently over the next following segment, so that the side of strobila appears serrate. Male organs: Testicles 50 to 60 μ in diameter, arranged in two groups in each segment, one on each side of the median field near the ovary; cirrus pouch small, sacular, contains a small vesicula seminalis and the retracted and coiled penis. Female organs: The female anlagen appear as early as the twenty-fifth segment; female glands quite close to ventral canal; uterus same as in *C. pectinata*. Excretory system: Circular canal said to be absent from the head; a median canal forms a dorsal and a ventral loop between the suckers; each loop branches, one forming the two ventral canals, the other the two dorsal canals; the ventral canals are connected by the transverse canals in each segment, but in the posterior segments a network of canals supplants the ordinary transverse canals; a second canal system—evidently the dorsal canals—is described as possessing a thick muscular layer. It is figured as lying between the ventral canal and nerve. Ova, 67 to 70 μ in diameter. Of more than 150 wild rabbits, only 10 to 12 were not infested with this parasite. (Abstract.)

Neumann[2] in 1888 placed the worm in the genus *Tænia;* later[3] he reverted to *Dipylidium* and recorded a worm from the domesticated rab bit which he considered identical with this form. Railliet in 1890 found this worm in France and proposed the name *Tænia ctenoides* in place of *T. leuckarti* (Riehm, 1881), Neumann, 1888 [nec Krabbe, 1869].

R. Blanchard[4] in 1891 placed this species in the genus *Moniezia*, translating Riehm's diagnosis.

Railliet in 1893 transferred the species to his genus *Ctenotænia*.

I have examined one of Riehm's originals, and, through the kindness of R. Blanchard, I have received several tapeworms under the label "*Tænia pectinata*, Lapin domestique, 10, 8, 89. G. Marchal. Hucqueliers près Montrei—[?] sur mer." These worms agree with Riehm's specimens of *Dipylidium leuckarti*. One of Moniez's specimens labeled "Açores" is also a *D. leuckarti*. Upon the material at my disposal and Riehm's anatomical discussion I base the following revised specific diagnosis:

[1] Stud. an Cestoden. Zeitschr. ges. Naturw., 3 ser., VI, p. 200; pp. 566-575.

[2] Traité des maladies parasitaires, Paris, 1888, p. 426.

[3] Traité des maladies parasitaires, Paris, 2d ed., 1892, p. 461. Parasites and Parasitic Diseases of Domesticated Animals, London, 1892, p. 473.

[4] Mém. Soc. zool. France, IV, p. 187; pp. 450-451.

Diagnosis.—*Cittotænia ctenoides* (Railliet, 1890), Stiles, 1896. Strobila serrate may attain 80 cm. in length by 10 mm. in breadth; composed of 500 to 750 segments, which are always at least 3 to 5 times broader than long. Head unarmed, about 0.44 to 0.5 mm. broad by 0.16 mm. thick; no rostellum visible. Suckers 0.176 mm. in diameter. Neck short and broad, or absent, segmentation beginning immediately back of the head. Genital pores double, situated in posterior half of margin. Male organs: Testicles arranged in two groups in lateral portion of median field; about 60 to 80 testicles to each group, 50 to 60 μ in diameter. Cirrus pouch small, 0.16 mm. long by 0.128 mm. broad; it does not reach the longitudinal nerve; contains the coiled and inverted cirrus and a small vesicula seminalis. Female organs: Ovary, vitellogene, and shell glands agree in general with the same organs in *C. pectinata*, but are situated much closer to the longitudinal canals; uterus agrees with that of *C. pectinata*, but appears to be rather more simple. Dorsal canal lies between ventral canal and nerve or dorsal of ventral canal. Vas deferens, vagina, and uterus extend from median field into lateral field dorsally of the longitudinal canals and nerves. Ova, 64 μ in diameter; bulb of pyriform body, 20 μ.

Hosts.—European wild rabbit (*Lepus cuniculus*), by Riehm; tame rabbit (*L. cuniculus domesticus*), by Neumann, Railliet, and Marchal.

Types.—Cotype, No. 1327, U.S.N.M. (from collection of Riehm). Typical specimens: No. 114, U.S.N.M. (from collection of Blanchard); Nos. 1449.4 and 1457, U.S.N.M. (from collection of Moniez); collection of Blanchard; collection of Moniez.

Geographical distribution.—Europe: Saxony, by Riehm; France, by Neumann, Railliet, Marchal, Moniez. The Azores (collection of Moniez).

CITTOTÆNIA PRÆCOQUIS (Stiles, 1895), Stiles & Hassall, 1896.

(Plate XV, figs. 1–6.)

1895, *Ctenotænia præcoquus* [typographical error for *præcoquis*], STILES, Veterinary Magazine, II, June, p. 345. Aug. 28, 1895.

1896, *Cittotænia præcoquis* (STILES, 1895), STILES & HASSALL, Veterinary Magazine, III, p. 407.

Prof. Herbert Osborne, of Ames, Iowa, collected two specimens of tapeworms from the Pocket-Gopher (*Geomys bursarius*), which he presented to the Bureau of Animal Industry. The species is rather a difficult one to interpret, especially upon press preparations, and the limited amount of material does not allow a minute anatomical analysis by means of sections, but sufficient characters can be given to enable one to easily recognize the form.

The specimens measure about 40 mm. long and contain about 150 segments; the greatest breadth, about 5.5 mm., is reached about 10 mm. from the distal extremity; the distal 10 mm. becomes narrower. Head not very distinct from the strobila, 0.43 mm. broad by 0.32 mm. long. No rostellum visible; no hooks present; sucker 0.16 mm. long by 0.128 mm. broad.

Neck very short and broad. Segmentation visible 0.56 mm. from anterior extremity of the head. The proglottids rapidly become distinct, and in the specimens at hand the posterior border of each segment overlaps the anterior border of the next following segment for about one-third of its length in the anterior segments to one-sixth of its length in the posterior segments. The genital anlagen become visible almost immediately after the segmentation. The genital pores are double and opposite in about the middle of the lateral margin. Male organs: The testicles are numerous and are scattered over the entire dorsal portion of the median field, but do not quite reach the lateral canals; in the middle portion of the median field they extend farther ventral than in the lateral portion. The cirrus pouch lies dorsal and slightly posterior to the vagina on both sides of the segment; it is 0.24 mm. long by 96 μ broad (proximal end); it is relatively muscular; the lateral portion is narrow, but the proximal portion is swollen to contain a globular vesicula seminalis; the vas deferens coils and curves from here median and cephalad, the convexity of the curve being distal. Female organs: The female glands lie in the median field, about halfway between the median line and lateral canals; they were not analyzed in detail; details of the development of the uterus must also be left to some one who can obtain further material; the vagina lies ventral and slightly proximal to the cirrus-pouch on both sides of the segment; it is narrow, 19 mm. long, and extends to a point slightly dorso-median of the ventral canal, where it swells into an enormous receptaculum seminis which occupies the ventro-lateral portion of the median field, and in some sections measures 0.72 mm. long by 0.19 mm. broad; median of this organ and ventral of the testicles are situated the female glands; there is apparently a common uterus to both ovaries; it is situated ventrally of the testicles at the height of the genital pores, but proximally and distally of this plane it extends farther dorsad; sections on other planes than that of the pore show that dorso-ventral trabeculæ of the body stroma divide the uterus into numerous pouches, although sections at the pores generally show a more or less continuous transverse stem: the ova are unusually small, measuring 32 to 36 μ in diameter; the bulb of the pyriform body varies between 8 μ and 12 μ; the horns are relatively long and crossed. Excretory and nervous systems: At the height of the genital pores the dorsal canal lies between the ventral canal and nerve; in other planes it may lie dorsal of the ventral canal. The genital canals pass dorsally while the uterus passes ventrally of the longitudinal canals and nerves.

As specific name, I proposed *praecoquis* (misprinted as *praecoquus* in the original description), referring to the unusually early development of the genital organs. The following is proposed as a specific diagnosis:

Diagnosis.—Cittotænia praecoquis (Stiles, 1895), Stiles & Hassall, 1896. Strobila attains about 40 mm. in length by 5.5 mm. in breadth by 0.72 mm. in thickness; the posterior 10 mm. is slightly narrowed.

Head unarmed, not very distinct from strobila, 0.43 mm. broad by 0.32 mm. long; rostellum not observed; suckers 0.16 mm. long by 0.128 mm. broad. Neck short and broad. Segmentation begins about 0.56 mm. from the anterior extremity of head. About 150 proglottids present, very distinct; the posterior flap overlaps the anterior one-third to one-sixth of the next following segment. Genital pores double and opposite, not prominent, in about the middle of the lateral margin. Male organs: Testicles numerous, confined to dorsal portion of median field; cirrus pouch dorsal of vagina on both sides of segment, 0.24 mm. long, muscular, containing globular receptaculum seminis (about 90 μ diameter) in its proximal portion; it extends to or slightly beyond the ventral canal. Female organs: Female glands about halfway between median line and ventral canal; vagina narrow, extends across ventral canal, then dilates into a large receptaculum seminis; uterus probably single, possessing blind proximal and distal pouches. Ova, 32 to 36 μ in diameter; bulb of pyriform body, 8 to 12 μ; horns long and crossed. Excretory system: Dorsal canal between ventral canal and nerve at height of the genital canals; genital canals cross dorsally, but uterus crosses ventrally, of the longitudinal canals and nerves.

Hosts.—Pocket Gopher (*Geomys bursarius* (Shaw, 1800)[1]), collected by Herbert Osborne at Ames, Iowa.

Types.—Bureau of Animal Industry cestode series No. 1079 designated as type and deposited in the United States National Museum; paratype (1372, part in sections) deposited with type. Technique of types: Corrosive sublimate, alcohol, acid carmine.

PECTINATA GROUP.

The European form *Cittotænia pectinata* forms, with certain American parasites, a very compact group, but it is difficult to know what rank should be given to this division. Generic rank would be too high, specific rank too low. I propose to include these cestodes in the *Pectinata* group, which I base upon the peculiar cirrus pouch.

Three species come within this group at present:

1. Type species *C. pectinata*, as defined below, p. 188, its chief characters being the length of the cirrus pouch, the quadrangular arrangement of the testicles, and their extension beyond the ovaries to the lateral canals.

[1]Synonymy after Merriam: 1800, *Mus bursarius*, Shaw; 1815, ? *M. ludovicianus*, Ordway; 1817, *Diplostoma fusca*, Rafinesque; 1817, *Geomys cinerea*, Rafinesque (*Mus bursarius* renamed); 1820, *Saccophorus bursarius*, Kuhl; 1821, *Mus saccatus*, Mitchill; 1823, *Pseudostoma bursarius*, Say; (1822) 1825, *Ascomys canadensis*, Lichtenfel l; 1859, *Geomys? bursarius*, Richardson; 1852, *Geomys canadensis*, LeConte; 1852, *G. oregonensis*, LeConte.

C. Hart Merriam, 1895. Monographic Revision of the Pocket Gophers, Family Geomyidæ (exclusive of the species of *Thomomys*), p. 120. North American Fauna, No. 8, Division of Ornithology and Mammalogy, United States Department of Agriculture.

2. The second species, *C. perplexa*, is directly intermediate between the first and third, but I am unable to find connecting links between it and the other forms. The cirrus pouch is about two-thirds as large as that of *C. pectinata* and somewhat more distinct than that of *C. variabilis;* the testicles are arranged in two triangles and extend laterally beyond the ovaries to the lateral canals. In general configuration of the body it resembles *C. pectinata* very closely, but is much shorter.

3. *C. variabilis* represents the last form of the series, presenting a cirrus pouch slightly smaller than that of *C. perplexa* and testicles in a quadrangle which is confined entirely to the space between the ovaries. It occurs in three different forms as follows:

(*a*) *C. variabilis* found in *Lepus sylvaticus* with characters described below, p. 192, measuring up to 10 mm. broad, the segments always much broader than long.

(*b*) *C. variabilis angusta* differs from *C. variabilis* only in point of size; it measures only 2 mm. broad and the segments are about three times as broad as long. This form I have never found with ova, and it may be a case of arrested development. Those authors who take external form as a specific character would be obliged to give this parasite specific rank, but I am unable to admit this view. This variety is found in *Lepus sylvaticus.*

(*c*) *C. variabilis imbricata* is the third variety, and is one due probably entirely to host influence. It is found in *Lepus palustris* in Florida. The differences between this form and the type are but very slight; the posterior margins are more scalloped, the segments more imbricate, and the cirrus pouch slightly more distinct.

CITTOTÆNIA PECTINATA (Goeze, 1782 partim, Riehm, 1881), Stiles & Hassall, 1896.

(Plate XVI, figs. 1–2; Plate XVII, figs. 1–2.)

†1781, *Tænia acutissima*, PALLAS, Neue nord. Beyträge, I, pp. 75–81, pl. III, fig. 25.

1782, *T. pectinata*, GOEZE, Versuch einer Naturgeschichte d. Eingeweidew., pp. 363–368, pl. XXVII, figs. 7–13.

†1800, *Alyselminthus pectinatus* (GOEZE, 1782), ZEDER, Erster Nachtrag zur Naturg. d. Eingeweidewürmer, pp. 246–249.

†1803, *Halysis pectinata* (GOEZE, 1782), ZEDER, Anleitung zur Naturg. d. Eingeweidewürmer, p. 332.

1810, *Tænia leporina*[1] RUDOLPHI (in synonymy), Ent. Hist. Nat., II, Pt. 2, p. 82.

1881, *Dipylidium pectinatum* (GOEZE, 1782 partim), RIEHM, Zeitschr. f. d. ges. Naturwiss., 3 ser., VI, p. 200; pp. 575–583, pl. V, figs. 4, 14; VI, figs 4, 7.

1891, *Moniezia pectinata* (GOEZE, 1782 partim, Riehm, 1881), R. BLANCHARD, Mém. Soc. zool. France, IV, pp. 187, 445, 450–452, 457–460, figs. 26–30.

1893, *Ctenotænia pectinata* (GOEZE, 1782 partim, Riehm, 1881), RAILLIET, Traité de Zool. méd. et agric., I, pp. 278–279.

1896, *Cittotænia pectinata* (GOEZE, 1782 partim, RIEHM, 1881), STILES & HASSALL, Veterinary Magazine, III, p. 407.

[1] Blanchard (1891A, p. 457) has already shown that Limbourg (1766) did not use "*Tænia leporina*" as a specific name; the name therefore dates from Rudolphi, 1810.

Marigues[1] in 1778 mentions and figures tapeworms found in the body cavity of rabbits; but it is impossible to determine what species he had before him.

Pallas in 1781 found no tapeworms in the many hares he examined. He received some worms taken by Graf von Bork from hares and described them as *Tænia acutissima*. The worm is evidently a double-pored leporine form, and on that account probably a *Cittotænia*; but from the description given by Pallas it is impossible to definitely decide which of the three leporine double-pored forms he had before him. On this account I do not consider myself justified in reinstating the specific name *acutissima*.

Pallas evidently thought that *Drepanidotænia lanceolata* of geese was identical with the leporine form, and he also placed *Schistocephalus* from the body cavity of *Gasterosteus* side by side with the parasite of hares, although his text clearly shows that he thought further investigation might result in separating *Schistocephalus* as a distinct species.

Goeze in 1782 states that *Tænia pectinata* is found in hares and wild rabbits, but he never found it in tame rabbits; he mentions its similarity to a parasite (*Drepanidotænia lanceolata*) of geese, to one (*Schistocephalus solidus*) of the Stickle-back (*Gasterosteus*) and to the broad tapeworm (*Moniezia expansa*) of sheep, but does not consider it specifically identical with any of these forms. Goeze found the species nearly always present in 1-year old hares and in wild rabbits, often 20 to 30 in an individual host. "The margins of each segment were rather bluntly rounded, and on this rounding, by means of the hand lens a very small opening was visible, out of which eggs could be pressed, and out of which, when the live worms were placed in hot water, through the sudden contraction of the canals, they were pressed in small threads." The first part of this quotation, "the margins, etc." ("Die Seitenrände jedes Gliedes kulpichtrund, und auf dieser Ruendung") is the only portion of Goeze's article which can be interpreted as referring to double pores. His figures do not show pores, but Figure 7 *makes the impression upon a worker of being a* double-pored cestode. The head is described as very small; segmentation begins almost immediately back of the head; the segments increase in size very rapidly; four suckers on head, but no hooks; of thirteen specimens the longest measured about 6 inches; it possessed 204 segments.

Zeder in 1800 placed Goeze's specific name in the genus *Alyselminthus*, and gave a discussion of the parasite which he supposed was identical with Goeze's form. He states, however, that he found only a single pore to each segment. While it seems possible that Zeder's form is identical with *Andrya rhopalocephala*, as assumed by several authors, the point can not be definitely settled, as Zeder's description

[1] Observations sur des vers Ténia trouvés dans le ventre de quelques lapins sauvages; Observations sur la physique, etc. (Rozier), XII, Paris, pp. 229–231, pl. II, fig. 3.

is too indefinite to allow a specific or even generic determination. In 1803 he transferred the species to *Halysis*.

Rudolphi[1] in 1810, as Riehm remarks, certainly had more than Goeze's species in mind when he wrote his diagnosis; a portion of his description applies very well to *C. denticulata*, and a portion to *C. ctenoides*. He includes Zeder's single-pored form in *T. pectinata*. The fragment of Rudolphi's (1810) specimen of *T. pectinata* which I examined is so poorly preserved that no statements can be made on it, but, as Stiles and Hassall in 1896 have shown, part of Rudolphi's original material of *T. denticulata* belongs to this species.

Bremser[2] in 1824 gives two figures of *T. pectinata*, in regard to which Riehm remarks that Figure 5 is an unquestionable *D. leuckarti*, while Figure 6 (head) is similar to *D. latissimum* (=*C. denticulata*).

Diesing's[3] description of 1850 can be made to apply to several different forms; he includes all the literature given for *T. pectinata*.

Our chief knowledge of *C. pectinata* we owe to Riehm in 1881, who studied its anatomy in detail. Riehm divided the heterogeneous mass of tapeworms, which earlier authors had included under the term *T. pectinata*, into five species, which he named *T. rhopalocephala* and *T. rhopaliocephala* (single-pored forms), and *Dipylidium pectinatum*, *D. leuckarti*, and *D. latissimum* (double-pored forms). This is the first time, therefore, that *T. pectinata* was described in detail, so that this species stands to-day upon Riehm's division, he having designated the particular parasite which should bear Goeze's specific name.

Riehm[4] diagnoses his form as follows:

Kopf hakenlos, ausserordentlich klein, kaum ½ mm. breit, gegen die lanzettförmig sich verbreiternde Strobila nicht abgesetzt. Geschlechtsöffnungen beiderseits, fast in der Mitte des Proglottidenrandes. Glieder kurz, trapezförmig, auch im gestrecktesten Zustande mindestens 4 mal breiter als lang. Länge des ausgestreckten Wurmes nicht über 40 cm. meist geringer. Breite der reifsten Proglottiden bis 8 mm. Die Strobila ist oft durch Längsfalten gestreift. Wohnthier: *Lepus timidus*.

This diagnosis is hardly detailed enough to meet the requirements of the present day, but in the anatomical description Riehm gives data which supply what is lacking in the passage just quoted. Many of the points he mentions can hardly be looked upon as specific characters, but should, I believe, be attributed to influences of technique, individual variation, and possibly the specific influences of environment, namely, the host—a subject to which the helminthology of the future must certainly give its most serious and careful consideration. The characters which appeal to me most in Riehm's description may be briefly summarized as follows:

Male organs: The testicles form a continuous band across the median field in the distal portion of the segment, and in Plate VI, fig. 4, they extend laterally close to the

[1] Entozoorum sive Vermium intestinalium Historia naturalis, II, Pt. 2, Amstelædami, pp. 82–84.

[2] Icones Helminthum, pl. XIV, figs. 5–6.

[3] Systema Helminthum, I, 1850, p. 498.

[4] Loc. cit., p. 575.

longitudinal canals; the cirrus pouch is deserving of special notice. In the majority of the known Tæniidæ the cirrus pouch is pyriform and rarely extends median of the ventral canal, but in *C. pectinata* it is a long narrow structure reminding one of the nozzle of a hose; Riehm gives its average length as more than 1 mm., and on Plate VI, fig. 4, shows that it is more than twice as long as the distance between the genital pore and the longitudinal canal. This extreme length of the pouch is a character of great importance. Female organs: The vagina, according to Riehm, is about as large as the cirrus pouch. At a point corresponding to the proximal end of the cirrus pouch it becomes suddenly very thin, and leads to a second swelling, the receptaculum seminis. The female glands correspond in all essential characters to those of the genus *Moniezia*, except that the ovary is described as composed of two quite distinct halves. Their position, some distance from the longitudinal canals, is striking. The uterus is said to be similar to that of *C. ctenoides*, namely "a common uterus for both sides, which extends the entire breadth of the segmen, and is constricted only in the middle, so that in the gravid segments the lateral portion appears swollen by the ova in comparison with the rather thin median portion. Its volume is also considerably increased laterally [namely, laterally to the uterus, longitudinal in reference to the worm] by apparently unbranched tubes which extend anteriorly and posteriorly. As a matter of fact, however, these tubes resolve themselves as the optical sections of a corresponding number of circular widenings of the uterus." Excretory system: The dorsal canals become obliterated some distance from the head. The transverse canals are connected with one another, not only by the ventral canals, but also by numerous smaller longitudinal canals. Topographically, Riehm figures the genital canals as dorsal of the nerve and longitudinal (ventral) canal. The parasite is said to occur only in the fall and first half of the winter, and only in hares. It was especially common around the Röblinger See, but rare on the higher plateaux of Saxony.

Blanchard[1] in 1891 states that he found this species in several hares of unknown origin. He has never found it in hares in the central part of France or around Paris, but found four specimens at Briançon in *Lepus variabilis*, killed at a height of 1,500 meters. His description, based upon these specimens, may be summarized as follows:

The largest specimen was 18 cm. long; maximum breadth, 7 to 10 mm.; head 315 to 340 μ broad; neck, 285 to 325 μ broad; in contracted specimens the neck may measure 1 mm. broad at the first segment; suckers elliptical, 142 μ long by 135 μ broad; opening, 80 μ long by 53 μ broad; mature segments, 7 to 10 mm. broad by 1.1 to 2 mm. long; penis smooth, 40 to 45 μ in diameter, extrudes 175 to 200 μ from pore; eggs generally polygonal from reciprocal pressure, but become elliptical or subspherical when pressure is removed; 80 to 90 μ by about 75 μ; outer membrane 1 to 2 μ thick; diameter of bulb of pyriform body 25 to 30 μ; length 40 to 50 μ; horns terminate in a long filament; hooks of oncosphere 8 μ.

Railliet[2] in 1893 places this species in his genus *Ctenotænia*.

Through the kindness of Dr. Brandes, I have obtained one of Riehm's original specimens of *Dipylidium pectinatum* for comparison with the American forms, and Blanchard has placed his forms from *L. variabilis* at my disposal. In my private collection I find several specimens of tapeworms from *Lepus timidus* which I collected in Leipzig in 1890, and which agree perfectly with Riehm's form. With this material at hand, together with one specimen from von Linstow and several from Moniez,

[1] Mém. Soc. zool. France, IV, pp. 445, 452, 457–460, figs. 26–30.
[2] Traité Zool. méd. et agric., I, pp. 278–279.

I can add a few points of importance to Riehm's diagnosis and lay greater stress upon other points which I think should be brought out more emphatically.

The anlagen of the female glands and genital canals appear in the earliest segments, while the testicles begin about 7 mm. back of the head. Male organs: The testicles are confined entirely to that portion of the segment which lies distally of the uterus, and they extend on both sides laterally of the ovaries to the longitudinal canals; this latter character is one of considerable importance when we compare the American and the European forms. Riehm has already directed attention to the long hoselike cirrus pouch and vagina, but I venture to call particular notice to their size and form.

Female organs: The excessive development which the female glands may attain is worthy of note: Riehm's statement that each ovary was divided into two halves I was unable to confirm. A peculiar feature of the female glands is that they develop suddenly and atrophy suddenly. In Riehm's cotype, for instance, the tubes of the ovary become visible 8 mm. from the anterior end (head lost); they then develop rapidly to a maximum and suddenly disappear, so that 22 mm. from the point where the ovarian tubes appear (or about 30 mm. from the anterior extremity) the ovary can no longer be seen; the testicles persist very much longer. The first trace of the uterus is seen about 12 mm. from the anterior end of specimen (about 14 mm. from anterior end of individual, if we allow 2 mm. for the lost head and first segments); the uterus passes on the ventral side of the ovary, and in all segments which I have examined there is a single uterine anlage extending across the segment.

The genital canals and uterus run dorsally of the nerve and ventral canal as Riehm figures them, and on transverse sections the cirrus is shown to lie dorsally of the vagina on both sides of the segment. The nerve is very close to the lateral margin.

Riehm gives no measurements for the ova; Blanchard (1891, p. 460) states that the ova measure 80 to 90 μ by 75 μ, and that the bulb of the pyriform body measures 25 to 30 μ in diameter. The measurements in Riehm's specimen are somewhat smaller, the ova varying from 72 to 84 μ, the bulb of the pyriform body 14 to 16 μ. My own specimens agree with Riehm's, but many of the ova do not exceed 56 μ in diameter.

The following is proposed as a revised specific diagnosis:

Diagnosis.—Cittotænia pectinata (Goeze, 1782, partim, Riehm, 1881), Stiles & Hassall, 1896. Strobila may attain 400 mm. in length and 8 mm. in breadth, anterior portion usually lanceolate. Head small, about 0.25 mm. or less in diameter, and about 0.125 mm. thick; rostellum and hooks not observed; suckers small. Neck very short, segmentation beginning almost immediately back of the head; the proglottids rapidly become distinct and are always much broader than long, the length being about one-seventh of the breadth; gravid posterior segments measure

about 10 mm. broad by 1.5 mm. long. The anlagen of the genital organs appear very early; the female anlagen are found near the longitudinal canals immediately back of the head; testicles appear about 6 mm. back of the head; genital pores double, in posterior half of margin. Male organs: The testicles are about 0.64 mm. in diameter; they are numerous, about 150 in number, confined to distal half of segment, posterior to uterus, and extend across the entire median field passing the ovary on each side to the longitudinal canals; cirrus pouch unusually large, attaining 1 mm. in length, extending some distance median of the longitudinal canals. Female organs: Ovary, shell gland, and vitellogene gland situated some distance median of the ventral canal, about 1 mm. or more from the lateral margin: a common transverse uterus to both ovaries; it passes the ovary ventrally, is generally larger in its lateral portions than in its median portion, and increases its volume by proximal and distal branches. Excretory system: Dorsal canal not observed; ventral canal median of nerve; transverse canals connected by secondary longitudinal canals. Longitudinal nerves close to lateral margin. Cirrus pouch, vagina, and uterus pass from median field into lateral field dorsally of nerve and longitudinal canals. Cirrus pouch dorsal of vagina on both sides of the segment. Ova globular 56 to 84 μ in diameter; bulb of pyriform body 14 to 16 μ; horns long, curved.

Hosts.—Common European hare (*Lepus timidus*) by Goeze, Riehm, von Linstow, and Stiles; Mountain hare (*L. variabilis*) by R. Blanchard. Development unknown.

Types.—Original types?. Cotypes of Riehm in the collection of Leuckart: No. 1411, U.S.N.M. Typical specimens in collection of Blanchard; collection of Moniez; collection of Stiles (Nos. 116, 1234, 1238, U.S.N.M.).

Geographical distribution.—Europe: Germany (Saxony by Riehm and Stiles; ? by Goeze); France (Briançon by R. Blanchard; ? Lille by Moniez).

CITTOTÆNIA PERPLEXA (Stiles, 1895), Stiles & Hassall, 1896.

(Plate XVIII, figs. 1–3.)

1895, *Ctenotænia perplexa*, STILES, Veterinary Magazine, II, June, p. 345. Aug. 28, 1896.
1896, *Cittotænia perplexa* (STILES, 1895), STILES & HASSALL, Veterinary Magazine, III, p. 407.

The specific name *perplexa* was proposed because it was so difficult to decide what to do with the form under discussion. Some half a dozen specimens were collected by Hassall from *Lepus sylvaticus* in Bowie, Maryland. They are all contracted and measure up to 57 mm. long by 10 mm. broad.

The parasite resembles *C. pectinata* in general form in the early appearance of the genital anlagen and in the fact that the testicles extend beyond the ovaries to the lateral canals. It differs from *C. pectinata* radically in the size of its cirrus pouch and vagina, and in the

fact that the testicles are almost absent from the median portion of the field, being arranged in two triangles.

C. perplexa agrees with *C. variabilis* in the general size of cirrus pouch. It differs from *C. variabilis* in the earlier appearance of the genital anlagen in the position and arrangement of the testicles. The following is proposed as specific diagnosis:

Diagnosis.—*Cittotænia perplexa* (Stiles, 1895), Stiles & Hassall, 1896. Strobila attains 57 mm. long by 10 mm. broad. Head unarmed, small, about 0.32 mm. broad, not distinctly separated from body; rostellum not observed; suckers 0.112 mm. in diameter. Neck extremely short, segmentation beginning almost immediately back of the head. Genital pores double, and opposite, in about the middle of the margin. Anlagen of female glands and canals visible within 0.64 mm. of the anterior extremity of the head. Male organs: Cirrus pouch similar to that of *C. variabilis*, but smaller, about 0.288 to 0.32 mm. long, extending to or slightly beyond the lateral nerves; testicles arranged in two groups in each segment, one triangle being around each ovary and extending laterally to the longitudinal canals. Female organs: Agree essentially with those of *C. variabilis*, as does the general topography; uterus single or double.

Host.—Cottontail Rabbit (*Lepus sylvaticus*) by Hassall in Bowie, Maryland.

Types.—Bureau of Animal industry, Cestode series, No. 1126, designated as type, and deposited in the United States National Museum. Paratypes in Bureau of Animal Industry; Nos. 1110, 1131, 1137–1139, U.S.N.M.; collection of Stiles; collection of Hassall. Other typical specimens will not be distributed until more material is obtained.

CITTOTÆNIA VARIABILIS (Stiles, 1895), Stiles & Hassall, 1896.

(Plate XIX, figs. 1–14; Plate XX, figs. 1–5.)

1892, "*Tænia pectinata*, GOEZE," 1782, ex parte of CURTICE, Journ. Comp. Med. Vet. Arch., XIII, pp. 232–233.

1895, *Ctenotænia variabilis*, STILES. Veterinary Magazine, II, June, p. 345. Aug. 28, 1896.

1896, *Cittotænia variabilis* (STILES, 1895), STILES & HASSALL, Veterinary Magazine, III, p. 407.

As stated in the introduction, helminthology is not so far advanced that it is possible for us to determine what limits should be given to genera, subgenera, species, and subspecies, and for some time to come all classification into groups must be looked upon as experimental, the ideas of every author being subject to change from day to day as new facts in the comparative anatomy of cestodes are published or observed. The American form which I now describe as *Cittotænia variabilis* is one of the parasites which can equally well be considered as a distinct species, or as a subspecies, possibly peculiar to given hosts. It is so perfectly distinct from the European *C. pectinata* that no specialist could fail to recognize the differences when he has the two forms side by side for comparison. Yet it is so closely allied to the European

C. pectinata that the question forces itself upon us whether these differences can not be considered as subspecific, possibly due to some extent to a difference of conditions found in different hosts and in different countries. I frankly admit that during an examination of a large series of specimens I have changed my mind a dozen times in regard to this particular species. I am now of the decided opinion, however, that this form should be given specific rank.

The specimens upon which this description is based were collected at Bowie, Maryland, by Hassall from the cottontail (*Lepus sylvaticus*). The strobila attains 100 to 180 mm. in length and 10 mm. in breadth.

The head is very small, measuring 0.32 to 0.56 mm. broad; it may or may not be sharply defined from the neck; no rostellum or hooks visible; the suckers are small, measuring 0.12 to 0.28 mm. long by 0.112 to 0.24 mm. broad; the opening of the sucker is directed diagonally forward. The neck is very short or absent, segmentation beginning very early and the proglottids rapidly becoming distinct. The anterior portion varies greatly in shape, according to contraction. The genital anlagen appear rather early; at about 5 to 10 mm. from the head two roundish bodies appear in each segment, one on each side of the median field near the longitudinal canals; these anlagen soon change in form to the pistol-shaped anlagen described for *Moniezia;* at about 25 mm. from the head the first testicles are visible. The genital pores are double and opposite, and situated in about the middle third of the margin.

Segments 125 mm. from the head measure 0.56 mm. long by 6.5 mm. broad by 0.48 mm. thick. Male organs: The testicles number about 65 to 90; they are confined to the dorsal half of the segment distally of the transverse uterus, and do not extend laterally of the ovaries. The cirrus pouch lies dorsally of the vagina on both sides of the segment; it is long, narrow, and quite indistinct, coloring in carmine much more lightly than the vagina. Female organs: The vagina runs ventrally of the cirrus; it is long and narrow. From the margin of the segment for a distance of about 0.48 mm. it is surrounded by a deeply coloring layer of cells, and then it is reduced to a thin narrow canal which later swells into the receptaculum seminis. The ovary, shell gland, and vitellogene gland resemble those of *Moniezia* and *C. pectinata* and lie 1.28 mm. from the lateral margin. The uterus may be double or single; in some segments a single uterine anlage extends across the entire segment, running through the ventral portion of the ovary, and passing to the lateral fields dorsally of the longitudinal canals and nerves; in the majority of segments there are two distinct uterine anlagen, one to each set of female glands. The ventral canal runs about midway between the ovary and the lateral margin; the dorsal canal lies dorsomedian of the ventral canal and is bound by a heavy cuticular lining. The longitudinal nerve lies laterally of the ventral canal, and ventrally of the genital ducts, about 0.64 mm. from the lateral margin.

In the older segments the topography described above is preserved,

but gradually the uterus develops to such an extent that it suppresses all the genital glands. The cirrus pouch becomes indistinct, but the vagina can be traced in nearly all segments.

As the uterus increases in size it gives rise to proximal and distal branches, but the latter are far less regular than those of the European *C. pectinata*. In the posterior segments it is generally difficult to distinguish the two uteri. The ova measure 60 to 64 μ in diameter; the bulb of the pyriform body, 12 to 16 μ. This is the species (var. *angusta*) upon which my paper, "A double-pored cestode with occasional single pores" was based, and since writing that note another case of the same variation was noticed. On account of the numerous variations in the position of the genital pores, uterus, etc., noticed in the specimens studied, I proposed to name the worm *Ctenotænia variabilis*.

Larval stage.—The young specimens described on page 201 were collected in the same locality as the species here described, and from the same host; and it seems probable that the unarmed young mentioned on page 201 are the young of either *C. variabilis* or *C. perplexa*.

Diagnosis.—*Cittotænia variabilis* (Stiles, 1895), Stiles & Hassall, 1896. (American representative of *C. pectinata*.) Strobila attains 100 to 180 mm. in length and 10 mm. in breadth. Head small, about 0.3 to 0.6 mm. in breadth; it may or may not be defined from the neck according to contraction. Neck very short, segmentation beginning almost immediately back of the head; segments always much broader than long. Genital anlagen appear very early, about 5 to 10 mm. from the head. Genital pores double, in about the middle third of the lateral margin. Male organs: Testicles about 60 to 100 in each segment, confined between the ovaries to the dorsal portion of the distal half of the median field; cirrus pouch about 0.4 mm. long, narrow and very indistinct, lying dorsally of the vagina on both sides of the segment. Female organs: Ovary, shell gland, and vitellogene gland resemble the corresponding organs of *Moniezia:* they lie median of longitudinal canals, about 1.3 mm. from the lateral margin: the vagina is rather distinct, lies ventrally of the cirrus pouch, and for about 0.5 mm. from the pore it is surrounded by deeply staining cells; uterus may be double or single (in the same specimen) and may produce proximal and distal branches; ova 60 to 64 μ in diameter; bulb of pyriform body 12 to 16 μ. Longitudinal nerve about 0.6 mm. from the lateral margin; ventral canal large with thin lining: dorsal canal much smaller than ventral canal, dorso-median of ventral canal, with thick lining; transverse canals connect ventral canals [no injections made for secondary longitudinal canals]. Genital ducts and uterus pass from median to lateral field on the dorsal side of the longitudinal canals and nerves.

Host.—Cottontail Rabbit (*Lepus sylvaticus*), by Hassall; Marsh Hare (*L. palustris*), by Mills.

Types.—Bureau of Animal Industry, Cestode series No. 117 designated as type and deposited in the United States National Museum. Paratypes distributed as follows: Collection of Bureau of Animal

Industry; collection of Leidy (University of Pennsylvania); collection of Harvard Museum of Comparative Zoology; collection of Ward; collection of Stiles; collection of Hassall. Europe: Berlin Museum; collection of Leuckart; collection of Max Braun; Halle Zoological Institute; Vienna Museum; collection of Stossich; collection of Parona; collection of Monticelli; collection of Zschokke; collection of R. Blanchard; collection of Railliet; collection of Neumann; collection of Moniez; British (South Kensington) Museum. Asia: Imperial University of Japan, Tokyo. Technique of types: Corrosive sublimate, acetic acid, acid carmine.

Unarmed young stages deposited in collection of Bureau of Animal Industry; collection of U.S.N.M.; collection of Stiles; collection of Hassall; collection of Berlin Museum; collection of Leuckart; collection of R. Blanchard.

Geographical distribution.—Maryland (by Hassall), Florida (by Mills), Long Island (by Peters), ? Puget Sound (collection of Leidy).

Varieties.—To classify the forms at my disposal, I am compelled to recognize three varieties:

(*a*) *C. variabilis.* B. A. I. Cestode series No. 117, type of the species is designated as type of this variety. The posterior flaps of the segments are nearly straight; genital pore in about the middle of the lateral margin. Habitat: *Lepus sylvaticus.*

(*b*) *C. variabilis angusta.* B. A. I. Cestode series No. 1119, designated as type and deposited in the United States National Museum. This variety is only about 2 mm. broad, the posterior flap is straight and does not overlap prominently, the genital pore is generally in the posterior half of the lateral margin. Pores occasionally single.

(*c*) *C. variabilis imbricata.* No. 1246, U.S.N.M., borrowed by B. A. I.; B. A. I. Cestode series No. 1246, designated as type and returned to United States National Museum. At first sight it seems almost like splitting hairs to create a variety for these specimens the technique of which was different from that of *C. variabilis.* The worms were collected by Robert Mills, an enthusiastic collector at Chuluota, Florida, and kindly presented to the United States National Museum. They were placed in 95 per cent alcohol, accordingly they are somewhat contracted. The posterior border of the segments is lobed, a character which is quite constant, and overlaps the next following segment about one-third of its length so that the segments have a general campulate appearance.

Subfamily DIPYLIDIINÆ, Railliet, 1896.

1850, Section *Rhynchotænia,*[1] DIESING, Systema Helminthum, I, p. 497.
1858, Subf. *Malacolepidota* (Soft-shell Tapeworms), WEINLAND, Human Cestoides, p. 52.
1863, *Cystoideæ,* R. Leuckart, Die menschlichen Parasiten, I, p. 389.
1861, Subg. *Rhynchotænia,*[1] DIESING, Sitzber. Akad. Wiss. Wien, XLIX, 1, p. 365.

[1] *Rhynchotænia,* Diesing, 1850, a "section" of *Tænia,* may be interpreted as a subgenus; by the law of priority, however, it falls as a synonym of *Fimbriaria,* Frölich, 1802, taking of course the same species as type, i. e., *Tænia mallens,* Goeze, 1782. In order to meet objection to this ruling, should objection arise, I here definitely propose *Tænia mallens,* Goeze, as type of the subgenus.

1884, Subg. *Microtænia*,[1] SEDGWICK, in CLAUS & SEDGWICK, Elementary Text-book of Zoology, I, p. 336.
1886, *Cystoidei*, R. LEUCKART, Die Parasiten des Menschen, 2d ed., I, p. 825.
1886, Group *Cystoidotæniæ*, RAILLIET, Éléments de Zool. méd. et agric., p. 253.
1896, *Dipylidiinæ*, RAILLIET, Recueil de Méd. vét., 8 ser., III, 5, p. 159.—STILES, Bull. 12, Bureau of Animal Industry, U. S. Dept. Agric., 1896, p. 28.

Diagnosis.—Tæniidæ with rostellum which is generally armed; genital pores lateral (marginal), single or double; eggs with thin transparent shells, frequently arranged in egg sacs, in some cases scattered through the segments; larval stage a cysticercoid; adults in birds and mammals.

Type.—*Dipylidium*, R. Leuckart, 1863.

Genus DAVAINEA, R. Blanchard & A. Railliet, 1891.

1891, *Davainea*, R. BLANCHARD & RAILLIET, Mém. Soc. zool. France, IV, p. 428. Type, *Tænia proglottina*, Davaine, 1860.
†1893, *Chapmania*, MONTICELLI, Naturalista Siciliano, XII (7-8-9), pp. 16–19. Type, *Tænia argentina*, Zschokke, 1888.

Diagnosis.—Dipylidiinæ of small or medium size. Head surmounted by a rostellum or hollowed by a depression, but armed in either case with a double row of numerous small hooks of special form (prong and dorsal root short, ventral root very long, giving to the hooks the form of a hammer). Suckers bordered with several rows of small hooks which may be instable or persistent. Genital pores unilateral or irregularly alternate; in the former case the ova are generally arranged in egg capsules; in some species the ovary develops into uterus; eggs may also be isolated, scattered through the parenchyma.

Type.—*Davainea proglottina* (Davaine, 1860), R. Blanchard, 1893.

Habitat.—Adults in intestine of birds and mammals; cysticercoids, generally in arthropods and mollusks.

This genus is found chiefly in birds, but two species have been recorded in mammals, besides the two species here given for *Lepus*. The diagnoses of the two other forms, which are introduced for comparison, read as follows:

DAVAINEA MADAGASCARIENSIS (Davaine, 1870), R. Blanchard, 1891.

1870, *Tænia madagascariensis*, DAVAINE, Mém. Soc. Biol. Paris, 5 ser., I (1869), 1870, pp. 233–240, pl. 1
1891, *Davainea madagascariensis* (DAVAINE, 1870), R. BLANCHARD, Mém. Soc. zool. France, IV, pp. 429, 438.

Diagnosis.—*Davainea madagascariensis* (Davaine, 1870), R. Blanchard, 1891. Strobila attains 250 to 300 mm. in length, and is formed of 500 to 600 trapezoidal segments which are broader than long. Head

[1]The subgenus *Microtænia* of the genus *Tænia* contains the species *Tænia cucumerina*, *T. elliptica*, *T. nana*, and *T. flavo-punctata*, and is thus antedated by the genera *Dipylidium*, Leuckart, 1863, *Diplacanthus*, Weinland, 1858 (nec L. Agassiz), and *Hymenolepis*, Weinland, 1858, but the type has never been proposed. In order to definitely dispose of the genus I propose *Tænia cucumerina* (= *Tænia canina*) as type, thus making *Microtænia* a synonym of *Dipylidium*.

provided with rather a large rostellum armed with a double crown of about 90 hooks 18 μ long. Suckers round and quite large; hooks on suckers not observed. Genital pores unilateral. A single egg in each egg sac.

Host.—Man (*Homo sapiens*). Found in Mayotte, Mauritius, and Bangkok.

DAVAINEA CONTORTA, Zschokke, 1895.

(Plate XXII, fig. 2.)

1895, *Davainea contorta*, ZSCHOKKE, Centralbl. f. Bakter. u. Parasitenk., Pt. I, XVII (18–19), pp. 634–645, figs. 1–4. 21 May.

Diagnosis.—*Davainea contorta*, Zschokke, 1895. Strobila attains 40 to 80 mm. in length by 0.75 mm. in breadth, and contains 400 to 800 segments, all of which are broader than long; margin of strobila serrate. Scolex small, prismatic; rostellum large, armed with (? a single row of) numerous minute hooklets; suckers large, armed with 8 to 10 rows of minute hooklets. Genital organs differentiate in fortieth to sixtieth segment. Genital pores unilateral, in middle of lateral margin. Male organs: Cirrus pouch one-fourth to one-third as long as the segment is broad; testicles two, large, in dorsal portion of median field on aporose side of median line. Female organs: Ovary bilobed; gravid segments filled with large egg capsules, each with a single egg possessing two shells.

Host.—Common Indian Pangolin (*Manis pentadactyla*). Type with Zschokke.

DAVAINEA RETRACTILIS, Stiles, 1895.

(Plate XXI, figs. 1–6; Plate XXII, fig. 1.)

1895, *Davainea retractilis*, STILES, Veterinary Magazine, II, June, p. 343. Aug. 28, 1895.

Of this species, I have seven strobilæ, collected March 10, 1891, in Nevada, by Dr. Fisher, of the Division of Mammalogy and Ornithology, United States Department of Agriculture. The original label reads: "Biological Explorations, U. S. Dept. Agr., Death Valley Expedition, Ash Meadows, Nevada, Mch. 10, 1891. A. K. Fisher. Nye Co. Tapeworms from Cottontail, No. 362." A reference to the specimen in the Division of Mammalogy and Ornithology shows that the host is *Lepus arizonæ*.

Measurements of Davainea retractilis.

B. A. I. Cestode series (No.).	Length.	Breadth.	Condition.
	mm.	*mm.*	
1168	35	3	Fragment.
1187	65	3	With head.
1188	98	3	Fragment.
1189	80	2.75	With head; type.
1190	68	2.75	Do.
1191	74	2.5	Fragment.
1192	105	3	With head.

All of the specimens are so contracted that a study of the general anatomy in detail is out of the question; enough can be given, however, to clearly define the species from other members of this genus. Taking the type specimen as basis for description, I find the following characters:

The head measures 0.480 mm. broad by 0.32 mm. long. The rostellum measures 80 μ in its tranverse and 48 μ in its longitudinal diameter; its equator is provided with a crown—on other preparations shown to be double—of minute hooklets 12 μ long. It is impossible to count the hooks, but there are about as many present as in *D. salmoni*—i. e., about 90 to 120. The suckers are oblong and measure 0.2 to 0.224 mm. by 0.14 to 0.16 mm.; they are armed with numerous hooklets arranged in rows. An estimate of their number is even more difficult than in the case of *Davainea salmoni* (see p. 198). There are about 75 diagonal rows of roots; from 5 to 20 roots have been counted in different rows. Five hundred to seven hundred hooks would probably not be a high estimate for each sucker. The suckers appear at first sight with low powers, to open at right angles to the longitudinal surface of the worm, but a careful study shows that the entire muscular bulb, together with its numerous hooks, is retracted into a sac-like structure which opens directly forward—namely, at right angles to a transverse section; in other words, the entire sucker is inverted in the parenchyma of the head; the direction of the opening of this invagination varies slightly in different specimens. A circular canal 9 μ in diameter surrounds the rostellum; a longitudinal canal runs in the dorsal and another in the ventral median line, which in all probability are connected with the circular canal, although this could not be absolutely demonstrated.

The contraction was such that the neck and the commencement of strobilization could not be judged satisfactorily, although the neck is apparently short, segmentation beginning near the head. As nearly as could be estimated, the strobila contains about 950 segments; in this estimate about 300 segments are allowed for the first 10 mm. of the worm. In the anterior portion, the four longitudinal canals are very distinct and laterally the longitudinal nerve is indistinctly visible; the larger (evidently ventral) canal is lateral of the smaller (dorsal) canal. About 1.12 mm. from the head a small deeply-staining line of cells develops in the median line of the segments, running parallel to the anterior margin; this gradually increases in length as the segments are followed distally; this is interpreted as the anlage of the genital canals and probably also of the female glands. Very shortly after its appearance two groups of testicles are noticed, one group each side of the median line. The cirrus pouch and vagina appear in the lateral field, all of the genital pores being unilateral in the anterior half of the segment. The pouch is small, measuring 0.12 mm. long by 60 μ broad; no clearly defined vesicula seminalis could be seen, but the coils made by the retracted cirrus appear to occupy the entire pouch; the vagina is

immediately distal of the pouch. The changes in the genital system must be left for some one to study who can preserve fresh material for this purpose. Gradually the entire median field becomes filled with eggs; while several eggs are contained in each capsule in *D. salmoni*, the arrangement in *D. retractilis*, so far as could be judged from the poor material, agrees more closely with that described for *D. contorta* and *D. madagascariensis*, each capsule containing but one egg. The ova are about 80 μ in diameter and possess two (?) surrounding membranes.

The segments are all broader than long, variations being found between 0.56 mm. broad by 4 μ long (anterior segments) and 3 mm. broad by 0.24 mm. long. The distal segments are slightly narrower, but there is not the sudden and distinct change seen in *D. salmoni*. As specific name I have proposed *Davainea retractilis*, referring to the retracted condition of the suckers found upon all the heads examined.

The material at hand does not warrant further description, but from the data given the following diagnosis is proposed:

Diagnosis.—*Davainea retractilis*, Stiles, 1895. Strobila 105 mm. or more long by 3 mm. broad, with about 1,000 segments, all of which are much broader than long; segments vary from 0.56 mm. broad by 4 μ long (anterior segments) to 3 mm. broad by 0.24 mm. long (gravid segments). Head measures 0.37 to 0.68 mm. broad by 0.36 to 0.43 mm. long. Retractile rostellum 80 μ by 48 μ, armed with a double row of minute hooklets 12 μ long, about 40 to 60 hooks in each row. Suckers measure 0.2 by 0.14 mm., and may be completely retracted into the head; they are armed with numerous hooklets arranged in rows; the roots arrange themselves regularly in rows, about 75 diagonal rows coming to each sucker, and 5 to 20 roots in each row; about 500 to 700 hooks are estimated for each sucker. Neck is short or absent, strobilization beginning almost immediately back of the head. Longitudinal canals at first very distinct, ventral canal lateral of dorsal canal. Genital anlage appears about 1 mm. from the head, and is at first median; testicles arranged in two groups, one each side of the median line. Genital pores unilateral, cirrus pouch small, 0.12 mm. long by 60 μ broad; vagina immediately distal to pouch. Eggs 80 μ in diameter, inner shell 40 μ; a single egg in each egg capsule.

Host.—One of the cottontail rabbits (*Lepus arizonæ*) by A. K. Fisher; development not known.

Types.—Diagnosis based upon four strobilæ with heads, and several fragments; Bureau of Animal Industry Cestode series No. 1189 is designated as *type* and deposited in the United States National Museum. Paratypes distributed as follows: Collection of Bureau of Animal Industry; Berlin Museum; Vienna Museum; collection of R. Blanchard. Fragments to British Museum; collection of Parona (Genoa); Tokyo University; collection of Zschokke (Bâle). All poorly preserved; technique, alchohol and hæmatoxylin or acid carmine.

Geographical distribution.—Nevada, by A. K. Fisher.

DAVAINEA SALMONI, Stiles, 1895.

(Plate XXII, figs. 3–4; Plate XXIII, figs. 1–9; Plate XXIV, figs. 1–2; Plate XXV, figs. 1–11.)

1887, "*Tænia pectinata*," GOEZE, 1782, of CURTICE ex parte, Science [N. Y.], March 23.
1895, *Davainea salmoni*, STILES, Veterinary Magazine, II, June, p. 343. Aug. 28, 1895.

The length of type specimen, mounted (Bureau of Animal Industry Cestode series No. 1196), is 86 mm.; the broadest segments attain 3 mm. in width. Total number of segments about 450 (the exact number could not be ascertained because of contraction at certain points), of which about 230 belong to the first third of the worm. Head 0.736 mm. broad by 0.496 long. Retracted rostellum 0.144 mm. in diameter, provided with a double crown of minute hooks, of characteristic *Davainea* form, 20 μ long, about 60 hooks in each row. The suckers are large and prominent and armed with rows of closely set hooks, the number of which it is utterly impossible to count; they may be estimated at about 750; the size of these hooks varies, the prong of the longest reaching 10 μ. The neck is thin (0.480 mm. broad) and short, segmentation beginning about 0.8 mm. back of the head. The segments vary extremely according to contraction, most of them being broad and short, but others being infundibuliform and nearly as long as broad. Within the proximal third of the strobila variations may be found between segments 0.512 mm. broad by 32 μ long and 0.7 mm. broad by 0.528 mm. long.

The anlage of the genital organs first appears in about the one hundred and seventieth segment, as a darkly staining body, one end of which is in the median line, the other pointed toward the pore side of the segment. As the segments are followed distally this body assumes the characteristic pistol shape found in the genital anlagen of so many tapeworms (*Moniezia*, etc.); the muzzle of the barrel rapidly reaching the lateral margin at the genital pore; the barrel divides into two parallel canals, the vas deferens proximally, the vagina distally, while the handle of the pistol grows distally in the median line to form the female glands in approximately the middle of the segment. The genital pores are irregularly alternate, and vary in position from the middle to near the anterior edge of the margin. The testicles appear at about the two hundred and thirtieth segment, and occupy almost the entire median field. The condition of the material does not warrant a description of the changes the female anlage undergoes, further than to state that the glandular portion divides into two (or probably three) bodies. The anterior body will by analogy represent the ovary, the distal body the vitellogene gland; the third (very indistinct) body would probably represent the shell gland. Canals could be seen between these glands, but could not be analyzed. The development of the uterus could not be followed, but after about the three hundred and fortieth segment groups of eggs gradually appear, suppressing

all of the genital glands. The cirrus pouch and vagina could not be studied in detail; the former is very small and muscular, and measures 0.14 mm. long by 44 μ broad. Excretory and nervous systems could not be analyzed.

These are all the details which can be given for the type specimen, but from some of the other material the following could be observed:

The vagina is distal of the cirrus pouch. The muscular layer of the cirrus pouch measures up to 20 μ thick. The cirrus when retracted forms several coils in the pouch, but no vesicula seminalis could be distinguished; in fact there is no room for one within the pouch when the cirrus is retracted. The egg capsules fill the entire median field of the segment, and occasionally extend into the lateral fields; there are about 160 visible upon one face of a segment; they are globular in form, but assume various shapes by reciprocal pressure; they measure 0.112 to 0.128 mm. in diameter and contain 3 to 15 ova; the ova measure 20 to 24 μ in diameter.

The posterior 10 to 20 segments decrease in breadth and increase in length very rapidly, in some cases measuring 1.8 mm. broad by 1.4 mm. long.

In some specimens the pores show a remarkable tendency to unilaterality; in fact, in two specimens which Dr. Norgaard has collected since this article was written all of the pores are on the same side of the worm. The position of the genital pore is evidently a very uncertain character in the genus *Davainea*.

Further details are not warranted by the material at hand.

As a name for this parasite, I proposed *Davainea salmoni*, dedicating the species to my friend and chief, Dr. Daniel E. Salmon, Chief of the Bureau of Animal Industry, United States Department of Agriculture, to whose broad policy of administration I am indebted for the opportunities of carrying on my work in helminthology.

The larval stage.—In December, 1887, Cooper Curtice examined a rabbit (*Lepus sylvaticus*) in which he found a number of tapeworms in various stages of development. He made an extremely important observation on the younger specimens, which, unfortunately, he never published.

In Science,[1] however, the following notice concerning Curtice's observation is found:

EARLY STAGES IN THE LIFE OF TÆNIA PECTINATA.

Thousands of sheep and lambs perish every winter on the ranches west of the Missouri River. They are not apparently afflicted with any disease. They are weak and lean in the fall, and simply seem to be unable to withstand the severity of the blizzards. The Bureau of Animal Industry of the Agricultural Department has been engaged in an investigation to ascertain, if possible, the cause of the weakness of the animals that perish, and Mr. Cooper Curtice visited the West in the prosecution of this work. An examination of the viscera of slaughtered sheep and lambs, fat

[1] March 23, 1888.

and healthy ones, as well as those that were weak and lean, disclosed the fact that they were almost without exception infected with tapeworms, which were found in the duodenum and gall duct. In the latter they were frequently so numerous as to close it up, and cause a suspension of its functions.

For the purpose of continuing his studies Mr. Curtice brought from the West a number of lambs, which were killed at intervals and their viscera examined, and this material having been exhausted, and it being inconvenient and expensive to obtain more, he turned his attention during the past winter to a study of the early stages in the life of the *Tænia pectinata* (common unarmed tapeworms of the rabbit). In studying these Mr. Curtice thinks he has made some interesting discoveries, which he presented to the Biological Society of Washington at a recent meeting.

The variety examined is found abundantly in nearly all rabbits in this locality. The life-history of the armed tapeworms of man and dogs has long been written, but that of the unarmed species inhabiting our domestic animals, especially cattle and sheep, is as yet comparatively unknown. As far as has been ascertained, the life-history of the *Tænia pectinata* is embraced in two stages. The first covers the development of the ova into the embryo, which is ready to leave the parent *Tænia*; the other covers the period of growth from the youngest forms yet found in rabbits to the adult stage. The life of the *Tænia* from the time they leave the first rabbit as an embryo until they are found as young *Tænia* in the second rabbit infected has as yet been unascertained. Among the theories that have been advanced is one that they pass this stage upon the ground, are eaten by insects, snails, or crustaceans, and that these are then eaten by the rabbits. This, however, is only a theory, as none have ever been found in snails, insects, or crustaceans.

It was Mr. Curtice's good fortune to find a rabbit which had recently been infected with these peculiar parasites, none of which were over 3 centimeters in length, many of them being less than 5 millimeters long. There were more *Tænia* in that rabbit than any he had ever seen before—about 85. Among the smaller *Tænia* were several specimens that showed the stages of development from nonsegmented, armed forms, to segmented, unarmed forms. Mr. Curtice showed to the society specimens illustrating the different stages.

The youngest forms detected were not the smallest, but measured about one-half a centimeter in length. They contained, in addition to the four suckers, a cup-shaped cavity in the place of the rostellum. Around the border of this cup-shaped cavity were situated 85 or 90 hooks. The older specimens show a similar cavity with no hooks. Still older ones show no cavity at all. All of these were in the nonsegmented stages, but other forms, some of them smaller, were without signs of hooks, and had already begun segmentation.

Mr. Curtice compared these stages with similar stages in *Tænia serata* [*serrata*], and said that the youngest stage of the *Tænia pectinata* was probably a cysticercoid stage and not the cysticercal, and that this was indicated by the cup-shaped cavity in the youngest forms of the *Tænia pectinata*.

In discussing the classification founded on the presence or absence of hooks, he declared it to be incorrect, since the discovery described above shows that the unarmed species in adult stages are armed in earlier stages.

The speaker exhibited some elegant drawings made by Dr. George Marx, illustrating the embryo as it leaves the parent *Tænia*. This embryo is six-hooked and surrounded by a curious pyriform envelope, to which there is a double prolongation, surmounted by a cap of the same substance. This cap has a shredded border, and is believed to be the remnants of a mass which, in an earlier stage, completely surrounded the embryo. This peculiar envelope has been previously noticed in Italy by Perroncito [Perroncito] and in France by Raillet [Railliet]. This stage is similar to that found in *Tænia expansa*, the unarmed tapeworm in sheep.

This article was copied in the Texas Live Stock Journal,[1] but, owing

[1]April 14, 1888.

to the inaccessibility of the publications and the lack of details, Curtice's observation has not received much attention from helminthologists.

The only authors—so far as I can find—who have taken cognizance of it are Neumann,[1] in 1892, and Railliet,[2] in 1893, and Braun. Railliet writes as follows:

Subfamily *Anoplocephalinæ*. * * * The life history is still unknown. However, C. Curtice has made an interesting observation on *Lepus sylvaticus*, which will possibly place experimenters in a position to determine the development. He found in the intestine a large number of small *Tæniadæ* which were still very young, but in different stages of development. Some of them 5 mm. long, nonsegmented, possessed between the suckers a dome-shaped depression, bordered with 85 to 90 hooks; others, still older, had lost their hooks, while some did not even show the corresponding depression; finally, some of them were segmented, but all of these were unarmed. One is thus led to suppose that the larval stage of the *Anoplocephalinæ* is represented by an armed cysticercoid and that the hooks disappear during the development. (Free translation.)

Curtice's observation I confirmed and extended in 1894.[3] Since publishing this note, Hassall has found the same young stages in several rabbits (*L. sylvaticus*) in Maryland, and with this material the former description can be amplified. Of the young forms collected some were studied fresh, others mounted.

Unarmed forms.—Nine of the mounted specimens showed no trace of any rostellum or hooks, but on the other hand some of them exhibited traces of segmentation. The details of measurements, etc., are as follows:

1. 0.544 mm. long; head, 0.24 mm. broad by 0.208 mm. long; constriction back of suckers 0.128 mm. broad; suckers, 0.112 mm. in diameter.

2. 0.848 mm. long; head, 0.256 mm. broad by 0.192 mm. long; constriction back of head, 0.12 mm. broad.

3. 0.304 mm. long; head, 0.208 mm. by 0.208 mm.

4. 7 mm. long; head, 0.448 mm. broad by 0.32 mm. long; suckers, 0.196 mm. diameter; constriction back of head, 0.368 mm. broad. The transverse lines of the segmentation become indistinctly visible almost immediately back of the head, but no genital anlagen are seen in any portion of the specimen.

5. 0.816 mm. long; head, 0.256 mm. broad by 0.24 mm. long; signs of segmentation.

6. 0.64 mm. long; head, 0.224 mm. broad by 0.176 mm. long; suckers, 0.112 mm. in diameter; segmentation begins 0.224 mm. back of the head.

7. 0.816 mm. long; head, 0.24 mm. broad by 0.192 mm. long; segmentation perceptible, 0.4 mm. back of head.

8. 0.64 mm. long; head, 0.24 mm. broad by 0.176 mm. long; segmentation, 0.224 mm. back of head; suckers, 0.144 mm. in diameter.

9. 0.656 mm. long; head, 0.24 mm. broad by 0.16 mm. long; suckers, 0.112 mm. in diameter; segmentation begins 0.288 mm. back of head.

Armed forms.—Twenty-seven mounted specimens in which rostellum and hooks were present varied in measurements as follows: Length,

[1] Traité des maladies parasitaires, 2d ed., p. 461.

[2] Traité de Zool. méd. et agric., I, p. 268.

[3] Notes sur les Parasites—31: Une phase précoce du ténias du Lapin, Bull. Soc. zool. France, XIX, pp. 163-165.

0.560 to 1.800 mm.: head, 0.352 to 0.512 mm. long by 0.320 to 0.480 mm. broad; rostellum, 0.176 to 0.240 mm. long by 0.112 to 0.160 mm. broad; number of hooks on rostellum, 100 to 122; on some fresh specimens as few as 90 hooks were counted; size of hooks on rostellum, 18 to 24 μ long.

As in the case of the unarmed heads mentioned above, there was a general though not absolute agreement between the size of the scolex and the length of the parasite, and there is no question in my mind that the head of a tapeworm is subject to increase in size after entering its final host; numerous observations upon young specimens of tapeworms from sheep support this view.

In none of these armed specimens was there the slightest trace of segmentation. In many cases the armature was not complete either upon the suckers[1] or upon the rostellum, but in all cases some hooks were found, and the rostellum was always visible.

Taking all these observations into consideration, I am forced to the conclusion that the unarmed forms and the armed forms represent the young stages of two different species. The unarmed forms I am inclined to bring into connection with *C. variabilis*, p. 192, while the close agreement between the rostellum of this young stage with that of *D. salmoni*, the agreement in the size of its hooks, the agreement in the general arrangement of the hooks on the suckers, the fact of their presence in the same host-species, and finally the fact that one of the adult specimens of *D. salmoni* (No. 1124, U.S.N.M.) was found in the same locality in which these forms were found, all lead me to the conclusion that the young armed stage here described represents the young of *Davainea salmoni*. Experimental demonstration of this view is, however, lacking. In several specimens studied alive, the cysticercoids were surrounded by a membrane (Plate XXV, figs. 4, 8, 10), which, however, became entirely lost upon being subjected to technique.

Armed larval forms distributed as follows.—America: Collections Bureau of Animal Industry; U.S.N.M.; Harvard; Leidy; Hassall; Stiles. Europe: British Museum; R. Blanchard; Railliet; Moniez; Zschokke; Parona; Berlin Museum; Leuckart; von Linstow; Looss; Halle Zoological Institute; F. E. Schulze. Specimens will also be sent to Neumann, Stossich, Monticelli, and Max Braun.

Diagnosis.—*Davainea salmoni*, Stiles, 1895. Strobila attains 86 mm. or more in length and 3 mm. in breadth, and contains about 450 segments which vary in form from nearly rectangular to infundibuliform according to contraction, most segments being much broader than long, the distal 15 to 20 segments becoming longer and narrower, nearly square, 1.8 by 1.4 mm. Head 0.6 to 0.736 mm. broad by 0.38 to 0.448 mm. long. Rostellum retractile, 0.1 to 0.14 mm. in diameter, armed

[1] The number of hooks given for the suckers (150 to 200 at least) in Notes sur les Parasites—31—is very greatly underestimated. It is utterly impossible to count them, but I should now estimate the number about 750 for each sucker.

with a double row of hooks 20 μ long, about 60 hooks in each row. Suckers comparatively large, 0.25 mm. in diameter, armed with numerous hooks of various sizes, the prongs of the longest attaining 10 μ in length. These hooks are arranged in about 7 to 9 concentric rows containing about 750 (estimated) hooks of various sizes. Neck short and thin, 0.8 mm. long by 0.48 mm. broad. Anlage of the genital organs appears about the one hundred and seventieth segment. Genital pores irregularly alternate situated in the middle to near the proximal portion of the margin, cirrus anterior to vagina; cirrus pouch small, 0.12 to 0.14 mm. long by 44 to 64 μ broad, muscular layer may attain 12 to 20 μ in thickness. Testicles occupy almost the entire median field except the center portion in which the female glands are located. Eggs are arranged in egg capsules, about 160 visible from one surface of the segment and measuring 0.112 to 0.118 mm. in diameter; 3 to 15 ova measuring 20 to 24 μ in diameter in each capsule.

Hosts.—Eastern Jackass Hare (*Lepus melanotis*) by Tallichet and Norgaard; cottontail (*L. sylvaticus*) by Curtice, Hassall, and Stiles; intermediate host unknown. Several specimens found in collection of Leidy, but collector's name is not stated on label.

Types.—Description taken from four strobilæ with heads, and several fragments. Bureau of Animal Industry Cestode series No. 1196 designated as type and deposited in the United States National Museum. Paratypes distributed as follows: Collection of Bureau of Animal Industry; Berlin Museum; collection of R. Blanchard. Fragments to South Kensington Museum and Vienna Museum. Technique of type specimen (poorly preserved), alcohol, hæmatoxylin.

Geographical distribution.—United States of North America; Texas (by Tallichet and Norgaard); ? (by Curtice); Maryland (by Hassall and Stiles).

GENERAL REMARKS.

Several interesting problems arise in connection with the adult cestodes described above and allied forms, to which it may be well to draw attention, notwithstanding the fact that the data at hand are not so complete and satisfactory as might be desired.

The uterus: Comparing the uteri of the known forms of the Anoplocephalinæ (exclusive of *Stilesia*), we find at least three distinct types represented in both the single-pored and the double-pored genera.

1. The most simple uterus appears first as a simple transverse tube extending across the median field of the segment, as in *Anoplocephala*. This same type of uterus is evidently found (see Meyner) also in *Bertia mucronata* and *Bertia conferta*. In the double-pored genus *Cittotænia* the anlage is generally single, but in some cases (*C. variabilis*) it may be single or double (divided) in the same strobila.

The increase in the size of this type of uterus takes place by an expansion of the uterus at certain points, giving rise to proximal and distal blind sacs or pouches. These pouches may be very distinct and

well defined, as in *Anoplocephala mamillana*, *A. wimerosa*, *Cittotænia marmotæ*, *C. pectinata;* or they may be less distinct (*C. variabilis*, *C. præcoquis*); or they may be totally absent (*C. variabilis*), in which case the uterine tube appears as an enlarged sac. In some species where they are at first well developed (*Anoplocephala mamillana* and *A. wimerosa*) their boundaries may disappear in the older segments, the uterus appearing as a sac.

The uterus of *C. denticulata* seems to be more complex and requires further study.

II. The genus *Thysanosoma* presents a totally different uterus. The anlage is originally a simple transverse tube as in the cases just mentioned, but the increase in size takes place by two different methods, which gives rise to quite a complicated structure. First, the anlage increases greatly in length, giving rise to numerous folds running longitudinally with the worm; next, this undulate tube forms blind pouches which are surrounded by a heavy layer of connective tissue, giving the pouch a characteristic appearance; the ova are deposited in these pouches and the original tube remains empty. The uterus of *Stilesia globipunctata* bears a certain resemblance to the uterus of *Thysanosoma* in that the egg pouches have a somewhat similar structure.

III. A third type of uterus appears to be presented by the genera. *Andrya* and *Moniezia*, and this type will require considerable study before it can be correctly interpreted. From the present status of our knowledge, however, it may be described as a complex system of branching and anastomosing tubes, a single set being present in *Andrya*, a double set in *Moniezia*. In the later stages of the uterus the boundaries of the tubes disappear and the uterus appears as a sac.

A transverse uterine anlage has not yet been recorded for these genera, except in the case of *Moniezia trigonophora*, for which species Stiles and Hassall[1] in 1893 have figured a short transverse canal which represented the earliest uterine stage they observed.

An interesting problem now presents itself, namely: In what relation do these types stand to each other? Have we here three parallel series of originally single-pored cestodes, each series with a particular type of uterus, and have the double pores been acquired independently after the three types of uteri became established? Or, do the single-pored forms represent one branch and the double-pored forms represent another, and have the three different types of uteri been developed independently in each branch?

The former supposition appears to me much the more probable, for in *Thysanosoma giardi* and *Cittotænia variabilis* we find both single and double pored segments.

This case represents one of the most interesting cases of homoplasy which has ever been observed in helminthology and should be

[1] Revision of adult cestodes of cattle, sheep, and allied animals, Bull. 4, Bur. An. Ind., U. S. Dept. Agric., pls. VIII, fig. 5; IX, fig. 3.

studied further when proper material is found. It is, however, by no means the only case of homoplasy brought forward in helminthology. I have[1] elsewhere called attention to the branching of the intestine in two distinct types of flukes, as represented by *Fasciola hepatica* and *Distomum delphini*. The presence of more than two testicles, as in two or more other distinct types of flukes represented by *Pleorchis polyorchis* and *P. mollis* on the one hand and *Distomum cygnoides* or *D. richardi* on the other is, in my opinion, another case of homoplasy. The development of double-pored forms in two distinct families (the Bothriocephalidæ—Blanchard's genus *Krabbea*, and a number of cases in which a few double-pored segments have been found in *Bothriocephalus latus*—and the Tæniidæ forms a fourth case of the same nature.

One of the greatest criticisms upon the present classification of parasites seems to me the fact that systematists have not taken into consideration the principle so well established in paleontology and other branches of zoology, namely, that the same structure may develop independently in several parallel series of animals. The sooner this principle is acknowledged the sooner we shall have a natural classification.

Zone of lateral growth.—A comparison of the older and younger segments of numerous Tæniidæ shows that as the segments grow broader, the median field—namely, the space between the two ventral canals—increases much more rapidly in proportion than the lateral fields—namely, the space between the ventral canals and the lateral margin. This establishes the median field as the greatest zone of lateral growth. No particular narrow zone of the median field can be looked upon as the zone of lateral growth for all cestodes, as is shown by a comparison of a large number of forms. In *Tænia* (type *T. solium*), for instance, the entire median field appears to participate in a more or less uniform lateral growth, for the genital glands retain their relative position, increasing in size in proportion to the increase in size of the segment; the same appears to hold for *Davainea*. In the anoplocephaline forms we find some interesting variations in the zone of growth, as is shown by the relative position of the ovaries to the ventral canals or to the median line. In *Thysanosoma giardi* the ovary bears an almost constant relation to the ventral canal, while the distance between the ovary and the median line constantly increases as the segment grows broader; in this case, therefore, there is but little growth between the ovary and the canal, while the growth in the median side of the ovary is very marked. The same holds true to a lesser degree in *Bertia americana*. In *Moniezia expansa* and *M. planissima* also the relation of the ovaries to the ventral canals remains almost constant, while the chief zone of growth is in the median field between the ovaries.

[1] The anatomy of the large American fluke (*Fasciola magna*) and a comparison with other species of the genus *Fasciola* s. st. vide p. 221, Jour. Comp. Med. Vet. Arch., 1895.

In *Cittotænia marmotæ* (Plate XI, fig. 5), *C. præcoquis*, and *C. pectinata* (Plate XVI), on the other hand, there also is a marked lateral growth between the ovary and the ventral canal while the lateral field remains nearly the same width throughout the entire length of the strobila. In *C. variabilis* (Plates XIX–XX) there is a marked growth in the lateral fields.

Abnormalities in the segments.—Riehm has already recorded segments of *Cittotænia denticulata* with three sets of female glands, and I have recorded segments of *C. variabilis augusta* with a single pore. New cases of both of these variations have been noticed in the preparation of this paper, namely, triple sets of female glands in *C. denticulata* and single pores in *C. variabilis*. I can look upon these cases, however, only as variations, similar to the occasional double pores in *Bothriocephalus latus* and *Thysanosoma giardi*, and can not ascribe to them any particular value from a systematic standpoint.

The value of the genital pores in classification.—Objection has arisen in some quarters to adopting the genital pore as the basis of classification. I both agree and disagree with this objection. It must not be forgotten that when Blanchard used the genital pores as basis for his classification, he naturally used the pore as representative of the genital system: thus, if the pores are single, the entire female system is generally single; if the pores are double, the entire system of female glands is generally double. Viewed from this standpoint (which is the only logical interpretation I can give to Blanchard's classification, proposed in 1891), I must insist upon the great value of the pores in classifying cestodes. At the same time I fully agree—and have stated so more than once before—that the pores unassociated with other characters can not be relied upon as basis for a natural classification of cestodes. Internal topographical anatomy must, in my opinion, form the basis of the natural classification for both Cestoda and Trematoda. The size and form of the segments are characters which we should use with the greatest caution, always making due allowances for technique and contraction; as generic characters I can under no circumstances admit their validity, and must therefore reject Sonsino's recently proposed genus *Panceria* (based essentially upon double-pored segments which are longer than broad) unless other characters are brought forward to place the genus on a firmer footing.

In systematic work in helminthology we must not lose sight of another principle which is well acknowledged in other specialities, namely, that a given character which may be of great importance in classifying the species or genera of one group does not necessarily hold as a taxonomic character in all genera or higher groups of the same order or class. Thus the unilaterality of the pores in *Hymenolepis* and *Anoplocephala* appears, so far as investigations have gone, to be a very important and constant character, while the same character must be used with the utmost precaution in the genus *Davainea*. I have shown

above that the pores of *D. salmoni*, for instance, may be either unilateral or irregularly alternate; the same holds for *D. tetragona*, and apparently also for *Andrya*. The characters to be used in classifying the species of any given genus must be determined separately for every genus by an examination of a large series of specimens from different localities and from different hosts. The unsatisfactory condition in which I have been obliged to leave the genera *Bertia* and *Andrya* is directly attributable to the limited amount of material at my disposal, and the fact that what few, and for the most poorly preserved, specimens I have examined represent only a few localities and a few hosts.

The influence of a host upon its parasites.—Considerable has been written upon the influence of various parasites upon their hosts, but very few authors have ventured to publish upon the influence of the hosts upon the parasites. This is probably due to two reasons: first, to the tendency on the part of many helminthologists to take the host species as a specific character of the parasite, and secondly the fact that the influence exerted by the parasite upon its host is a matter of economic importance, while the influence of the host upon the parasite would be looked upon by most workers as purely of scientific interest. To deny the economic importance of the host influence upon the parasite is, however, to my mind a short-sighted policy, for it must be this very host influence (i. e., environment) which has played an important rôle in the evolution of species, and which must have resulted in differentiating species and varieties, each of which after a time becomes in some cases at least dependent upon a single host. The genera *Demodex*, *Psoroptes*, and *Chorioptes* form excellent examples of the point under consideration; in these genera we find varieties which resemble each other so closely that it is often difficult and even impossible to determine the variety without knowing the host; experiments to breed some of the varieties of these genera upon other than their regular hosts, even though the experiment animal harbors a very closely allied variety of the same species, have been totally negative. This same variation is noticeable among worms. Specimens of *Moniezia expansa* taken from *Ovis aries* are for instance totally different from the specimens of the same species found in *Ovis laticauda;* the strobilæ from this latter host recently studied by Setti, which I have been able to examine through the kindness of my Italian colleague Prof. C. Parona, can not I believe be separated specifically from the European form, yet they certainly represent a distinct variety. Lönnberg has called attention to the variation in the hooks of avian cestodes taken from different hosts. I have also repeatedly noticed a variation in the spicules of the same species of nematode (*Strongylus contortus*, for instance) taken from cattle and sheep. To clearly define the varieties peculiar to certain hosts touches directly upon the question of transmission and infection, and on this account I submit that the study is of great economic as well as scientific importance.

The division of the genus Tænia.—In connection with the citations, p. 162, from Meyner's work, I take this occasion to reply to his remarks regarding the efforts which R. Blanchard, Railliet, Hassall, and I have recently made to bring some order into the genus *Tænia*. Upon page 8 of his thesis he says:

Die Versuche von Blanchard, Stiles und Railliet die Uebersichtlichkeit der Familie der Tæniaden durch Zerlegung in eine Anzahl von Unterfamilien zu erleichtern, sind nicht als besonders glückliche zu bezeichnen, namentlich mit Rücksicht darauf, dass die, von verschiedenen Gesichtspunkten ausgehende, stets nur an einer beschränkten Anzahl von Species vorgenommene Eintheilung nothgedrungen auch zu verschiedenen Resultaten führen musste. Bevor nicht durch eingehende Forschungen wenigstens die typischen Hauptformen als feststehend angesehen werden können, dürften derartige Experimente wohl nicht auf allgemeine Anerkennung zu rechnen haben, bis dahin aber verfehlen sie ganz entschieden ihren eigentlichen Zweck, nämlich Klarheit und Einfachheit in die Systematik zu bringen.

In writing this critique, which is of course welcomed both by my French colleagues Blanchard and Railliet, and by Hassall and myself as showing the view which Dr. Meyner takes of our work, the author has unfortunately overlooked several very important points. First of all, he has overlooked that very important principle so well expressed by Bacon in the words, "Truth emerges sooner from error than from confusion." None of us look upon our efforts to classify these parasites as perfect, free from criticism, and final beyond revision. But errors which we may have committed in these attempts to aid in reducing the chaos which exists in the genus *Tænia* can be corrected very easily. We have the satisfaction of knowing that our work has been adopted by a number of specialists in helminthology and hardly feel called upon to apologize for the attempts we have made, even if not approved of by Veterinarian Meyner.

A second error Dr. Meyner has fallen into is that he has forgotten that every classification must undergo an evolution (with epigenesis!).

He would evidently have us include all four-suckered tapeworms in the heterogeneous and collective genus *Tænia*, "until at least the typical chief-forms can be looked upon as established," although he failed to give an explanation of what he meant by "the typical chief-forms." If he refers to the type species of genera, he has lost sight of the fact that the type species of a genus is designated by any given author, and can not be changed after once being so designated. The type species is, therefore, optional, subject of course to certain principles, in the case of the author who designates it and obligatory in the case of other authors. Possibly Meyner refers to the most highly specialized species in the different groups. If so, however, his advice to wait until we study up such forms and decide which are the most highly specialized is wanting in reason. It is certainly far better to create a new genus for a form when we can not logically unite it with the known genera, than it is to place it with forms with which it does not agree in any important character.

Of course our efforts at classification are experimental—we all admit that; but from the very nature of things all efforts at classification in practically unknown groups are and must be experimental. The classifications must be changed time and again as new facts are discovered. Nor have our experiments (or, as Meyner puts it, "derartige Experimente") counted upon immediate general recognition (allgemeine Anerkennung); it was not with that end in view that we published them. We do not expect to see our proposed classifications adopted by zoologists at large until they have stood the test of other specialists in helminthology. We have not heard as yet, however, of any marked disapproval of the genera proposed from workers who were acquainted with the forms and who were competent to pass judgment on the case. When such authors propose a better classification, they can certainly count on Blanchard, Railliet, Hassall, and myself as four helminthologists who are ready to follow them. At present, however, I maintain that the classification originally proposed by Blanchard and since that time considerably expanded by Railliet, Hassall, and myself is a far more natural and satisfactory classification of the forms treated than any other classification ever proposed for the same forms. I am fully convinced, after a study of several thousand specimens, that the main features of the proposed division will stand, although the details of the system may undergo some changes. Helminthologists, as a class, are ultra-conservative in every line except species-making—and yet as long as the Rudolphi-Diesing school exerts such a powerful influence in wielding the yardstick instead of the microscope, perhaps this generic conservatism should be looked upon as a blessing.

A third error of Meyner's is that he does not understand the views which he has attempted to criticise, or the relative rank of the groups proposed, and he ascribes to authors propositions which they never made. Thus he states (page 6):

> Diese Anoplocephalinen theilt er (R. Blanchard) dann mit Rücksicht auf die Anordnung der Geschlechtsorgane in 3 *Unterfamilien* [!] ein und zwar (1) *Genre* Moniezia * * *; (2) *Genre* Anoplocephala * * *; (3) *Genre* Bertia * * *

Meyner thus makes the terms *subfamily* and *genus* synonymous—rather a novel idea in systematic zoology; he accredits (page 8) Blanchard and Railliet with a *family* "Anoplocephalen," although he states a few lines before that Railliet accepted "Anoplocephaliné" as a subfamily. Upon the same page he speaks of *Bertia* as a *genus* and *Ctenotænia* and *Andrya* as "*Arten*." It does not seem to me at all strange that our efforts should "fail totally in their object" with a worker who confounds such terms as species, genus, subfamily, and family.

A fourth error into which Meyner has fallen in the passage quoted is the assumption that we have taken only a few species into consideration in making our classifications. True, we have not felt called upon to give a list of all the species of cestodes with which we have acquaintance, either through personal study or through the publications

of our colleagues, but it would be going a little far to assume that we did not have other forms in mind at the time we revised a portion of the species known to us. Consistency being such a virtue, however, if Meyner considers the species mentioned in the former papers by the authors he criticises as representing the sum total of the species known to them, he will probably not object to applying the same criterion to himself. As he has published original work on only two species, however, it might be difficult for him to justify himself in attempting upon the basis of these two species to overthrow the conclusions which have been based upon a study of a much larger number of forms by four different specialists, all of whom agree in the general arrangement and differ with each other only in matters of detail. Meyner's remarks represent an excellent example of what is so common in science to-day, namely, a tendency to jump at conclusions and to generalize in a too dogmatic manner when one is not thoroughly at home on the subject he has under discussion.

The above remarks are, I think, sufficient to show that Meyner's amusing criticisms would better have been submitted to more careful thought before they were published. They can not have much weight with helminthologists, and should not have much weight with zoologists in other specialities.

A number of genera not discussed in this paper have been proposed by authors for various forms in the family Taeniidae. Some of these genera must be rejected. In regard to some of the others, judgment must be reserved for the present. I hope, however, to publish before long a summary of all the genera proposed. Regarding the newly proposed genera for avian cestodes, see Stiles,[1] 1896.

Exchange of cotypes.—There seems to be a popular impression among workers that it is a perfectly easy matter for a scientist to read a description of a species or genus and judge of the validity of the proposed form without examining specimens. This impression is certainly true in some cases, but must always be taken *cum grano salis.* I do not hesitate to assert that not one-half of the species and genera of parasitic worms ever described can be rightly judged from their descriptions, nor is this always attributable either to the description or to the ability of the worker attempting to pass judgment upon the case. It is rather attributable to the undeniable fact that a person obtains an entirely different impression from a study of the objects from what he obtains from reading a description, be it ever so detailed and complete. Many a species or genus has been accepted or rejected by an author who would have decided differently if he could have examined cotypes of the forms he was discussing.

In view of these facts, which I am confident the specialists in helminthology will admit, I wish to appeal again to helminthologists to

[1] Report upon the present knowledge of the tapeworms of poultry, Bull. 12, Bureau Animal Industry, Washington, D. C.

deposit cotypes with the chief museums of the world. It has been our policy to do this as far as possible, and as soon as the international postal laws[1] are amended so as to allow the acceptance of these specimens in the international mails, the system will be extended.

As a matter of justice, I believe the type specimen belongs in the national museum of the country in which the specimen was collected. The first duplicate (paratype) belongs by right to the Berlin Museum, as that museum now possesses more types of parasitic worms than probably any other collection in the world. I would set forth the claims of the United States National Museum for the second duplicate on the grounds that the European workers all have easy access to the specimens at Berlin, while the frequent sending of a rare and valuable specimen from Europe to this continent is attended with more or less danger of loss. Japan certainly has a claim to the third duplicate.

It is indeed time that helminthologists give the question of the preservation of types their serious consideration. Many of the older collections can not be traced; Davaine's collection is evidently destroyed, and many more private collections will follow it if more attention is not given to this subject.

CONCLUSIONS.

The chief results of this paper may be briefly summarized as follows:

1. The time has come when helminthologists must donate their type specimen of every species to museums where they can be properly cared for and where they may be open to the inspection of other specialists. I maintain that the original type rightfully belongs to the national museum of the country in which the specimen was collected; that the second specimen (first duplicate—first paratype) rightfully belongs to the Berlin Museum; that the United States National Museum has a valid claim for the third specimen (second duplicate), and that Japan has a valid claim for the fourth specimen.

2. In order to insure the preservation of types and cotypes, I invite the specialists in helminthology to unite upon some regular plan for the deposit and exchange of such specimens.

3. Permanent mount in balsam appears to me to be a much better method of preserving a type than to retain it as an alcohol specimen.

4. The known adult leporine cestodes belong to the five genera: *Anoplocephala*, *Andrya*, *Bertia*, *Cittotænia*, and *Davainea*.

5. Of these genera *Anoplocephala*, *Cittotænia*, and *Davainea* are considered as perfectly valid genera; *Andrya* and *Bertia* are left *sub judice*, although it is my impression that they will finally be recognized as valid, as soon as sufficient material can be properly studied.

[1]Owing to the absurd international postal regulation (16. 3. b.) excluding zoological specimens from the international mails, some of the paratypes mentioned as "distributed" in this paper have not yet been sent to the authors named; they will be forwarded as soon as an opportunity presents itself.

6. The microscope must supplant the yardstick and internal anatomy must take the place of external form in judging the validity of cestode and trematode genera and species.

7. The principle of homoplasy must be recognized by helmintholo. gists as well as by other zoologists, and any classification which leaves this important and well-recognized principle out of account can be taken only as a preliminary (although often necessary) study (p. 204).

8. The median field of the Tæniidæ is the seat of the most active lateral growth, and the same rule will probably be found to apply to other families of Cestoda. No particular longitudinal zone of the median field can, however, be named as the zone of most active growth in all Tæniidæ (p. 205).

9. The armed young cestode which I mentioned in Note 31[1] (1895) is not the young of an anoplocephaline tapeworm, as Curtice, Braun, Railliet, Neumann, and I had inferred, but represents the young stage of the single-pored cestode referred to in my paper in 1895.[2] It evidently belongs to *Davainea salmoni*.

10. The double-pored cestode with occasional single pores, described in my paper in 1895,[3] is *Cittotænia variabilis angusta*.

11. I have also found some very young stages of an unarmed cestode in the intestine of the cottontail rabbit, which probably belong to *Cittotænia variabilis*. This young stage corresponds to what we may expect to find as the larval form of *Moniezia expansa* of cattle and sheep, and I doubt whether it will be possible to distinguish it from the young of that species. This renders the question of the origin of the tapeworms of cattle and sheep more complicated than it was formerly supposed to be, and demands the strictest experimental proof on the part of any author who suspects that he has solved the mystery of the life history of the cestodes of cattle and sheep.

12. The head of a cestode increases in size after the parasite reaches its final host, as is shown by a comparison of the younger specimens.

13. None of the adult leporine tapeworms thus far described in Europe have as yet been found in America. The American forms which have been published as "*Tænia pectinata*" must be distributed over several species typical to this continent.

14. The following table includes all of the genera at present recognized in the subfamilies Tæniinæ, Mesocestoidinæ, Anoplocephalinæ, and Dipylidiinæ of the family Tæniidæ. A number of other genera have been proposed, but some of them must fall as synonyms, while judgment upon others must be reserved. Several of the genera in this key

[1] Notes sur les Parasites—31: Une phase précoce du Ténias du Lapin, Bull. Soc. zool. France, XIX, 1895, pp. 163–165.

[2] Notes on Parasites—36: A double-pored cestode with occasional single pores, Centralbl. f. Bakteriol. u. Parasitenk., 1. Abt., XVII, 1895, pp. 457–459.

[3] Loc. cit.

are accepted only provisionally,[1] while *Fimbriaria* is used at present only as a matter of convenience.

Key to the genera of the subfamilies Tæniinæ, Mesocestoidinæ, Anoplocephalinæ, and Dipylidiinæ of the cestode family Tæniidæ, including all the species of adult tapeworms found in hares and rabbits.

Tæniidæ.

[Tapeworms of hares and rabbits in roman.]

1. Head with four cup-shaped suckers; rostellum present, but not always evident; uterus without any special pore; genital pores generally marginal 2
   Head generally absent; genital pores marginal. Host: Birds 34
2. *Genital pores ventro-median* (Mesocestoidinæ) ..... *Mesocestoides.*[2]
   Genital pores marginal 3
3. Head never provided with hooks; uterus transverse or reticulate; egg generally with pyriform body; larval stage not known; adults in herbivorous and frugivorous mammals ..... *Inoplocephalinæ* (p. 149), 5
   Head nearly always provided with hooks (*T. saginata* an exception; see also *Hymenolepis*) 4
4. *Egg with thin outer shell and thick brown inner shell; uterus median and longitudinal with lateral branches; larval stage a cysticercus, cœnurus,* or *echinococcus, generally in herbivora; adults in carnivora* ..... (*Tæniinæ*) *Tænia.*[3]

[1] For *Andrya* and *Bertia*, see pp. 154, 160 of this paper. For the newly proposed genera *Amabilia, Choanotænia, Cotugnia, Dicranotænia, Drepanidotænia* in the subfamily Dipylidiinæ, see my Report upon the Present Knowledge of the Tapeworms of Poultry, Bull. 12, Bureau of Animal Industry, 1896.

[2] 1863, *Mesocestoides,* VAILLANT, L'Institut. No. 1524. Type, *Mesocestoides ambiguus,* Vaillant, 1863.

1885, *Ptychophysa,* HAMANN, Zeitschr. f. wiss. Zool., XLII, p. 740. Type, *Tænia lineata,* Goeze, 1782.

[3] 1758, *Tænia,* LINNÆUS, Systema naturæ, 10 ed., p. 646, 819. Type by elimination *Tænia solium,* Linnæus, 1758.

1800, *Alyselminthus,* ZEDER, Erster Nachtrag zur Naturg. d. Eingeweidewürmer, p. 221. *Tænia,* Linnæus, renamed, hence type *Tænia solium,* Linnæus, 1758.

1803, *Halysis,* ZEDER, Anleitung zur Naturg. d. Eingeweidewürmer, p. 298. *Alyselminthus,* Zeder, renamed, hence type *Tænia solium,* Linnæus, 1758.

1850, *Arhynchotænia,* DIESING, Systema helminthum, I, p. 497. Subgenus containing type of genus, hence type *Tænia solium,* Linnæus, 1758.

1858, *Acanthotrias,* WEINLAND, Human Cestoides. p. 51. Type, *Cysticercus acanthotrias,* Weinland, 1858 = *Cysticercus cellulosæ,* Rudolphi = larva of *Tænia solium.*

1858, *Tæniarhynchus,* WEINLAND, Human Cestoides, p. 46. Type, *Tænia mediocanellata,* Küchenmeister, 1852 = *Tænia saginata,* Goeze, 1782.

1858, *Echinococcifer,* WEINLAND, Human Cestoides, p. 52. Type, *Tænia echinococcus,* Siebold, 1853.

1863, *Cystotænia,* LEUCKART, Die menschlichen Parasiten, I, p. 223. As subgenus including type of genus, hence type *Tænia solium,* Linnæus, 1758.

To this list of synonyms must be added the subgenera *Cysticercus, Cœnurus,* and *Echinococcus.* They take the date and authority of the author who first used them in a subgeneric sense and not the date and authority of the author who first proposed them, since according to the International Code, section 48, b, the generic and specific names of larval cestodes (*Cysticercus, Cœnurus, Echinococcus, Finna, Hydatigena, Hydatis,* etc.) are not entitled to the law of priority.

The genus *Tænia* is frequently divided into three subgenera: *Cysticercus* (= *Cystotænia*), *Cœnurus,* and *Echinococcus. Tænia* must be substituted for the first subgenus (type *T. solium*) and *Echinococcifer* must probably be substituted for the third subgenus.

Egg with thin transparent shells; frequently in egg capsules; in some cases scattered through the segments; head nearly always armed with hooklets on rostellum; larval stage a cysticercoid; adults in birds and mammals.

Dipylidiinæ (p. 193), 27

Anoplocephalinæ.[1]

5. Ova with well developed pyriform body; genital canals pass dorsally of longitudinal canals and main nerve trunk (not yet satisfactorily demonstrated for *Andrya*)..... 6

Ova without pyriform body; genital canals pass dorsally of ventral canal and nerve, but ventrally of dorsal canal (not yet demonstrated for Stilesia centripunctata). 10

6. Uterus a transverse tube, generally continuous, in some of the double-pored forms divided (double), one tube for each ovary, and generally provided with proximal and distal pouches; dorsal canal lies dorsal to dorso-lateral of ventral canals; pedunculated prostatic gland absent..... 7

Uterus more like a network in its early stages; afterwards the boundaries of the meshes nearly or quite disappear and the uterus (or uteri) appears like a sac.. 9

[1] The genera of *Anoplocephalinæ* may also be determined by the following key, which although simpler than the one given above, is much more artificial:

Anoplocephalinæ.

A. Genital pores single..... B

Genital pores double..... F

B. Genital pores unilateral or irregularly alternate with decided tendency to unilaterality C

Genital pores regularly alternate or nearly so; pedunculate prostatic glands absent ..... D

C. Pores unilateral; testicles unilateral or nearly so in median field opposite pores; uterus transverse with proximal and distal pouches; pedunculate prostatic gland absent..... *Anoplocephala*, 11

Pores irregularly alternate with decided tendency to unilaterality; uterus forms a network in its younger stage, later the meshes become nearly or quite obliterated; testicles extend across the median field to or beyond the ovary; distinct pedunculated round or elongate prostatic gland present... *Andrya*, 26

D. Egg without pyriform body..... E.

Egg with well-developed pyriform body; uterus transverse with thin-walled proximal and distal pouches; genital canals pass dorsally of dorsal and ventral canals and main longitudinal nerve trunk..... *Bertia*, 14

E. *Uterus single and transverse, without pouches, or double, a cornucopia-like egg pouch being present near each ventral canal, the median transverse connecting canal not visible; genital canals pass dorsally of nerve and ventral canal, but ventrally of dorsal canal (not shown for* S. centripunctata) ..... *Stilesia.*

Uterus transverse but undulate, with thick-walled asconspore or cornucopia-like egg pouches; genital canals pass dorsally of nerve and ventral canal, but ventrally of dorsal canal ..... *Thysanosoma.*

F. *Egg without pyriform body; uterus transverse and undulate, with thick-walled asconspore or cornucopia-like egg pouches; genital canals pass dorsally of ventral canals and nerves, but ventrally of dorsal canal*..... *Thysanosoma.*

Egg with well-developed pyriform body; genital canals dorsally of ventral and dorsal canals and nerves..... G

G. Uterus a transverse tube, single or double, with thin-walled egg pouches; dorsal canal dorsal to dorso-lateral of ventral canal; vagina ventral of cirrus pouch on both sides of the segment..... *Cittotænia*, 19

Uterus reticulate, double; dorsal canal dorsal to dorso-median of ventral canal; vagina ventral of right cirrus pouch, dorsal of left cirrus pouch ..... *Moniezia.*

7. Genital pores single 8
Genital pores double; vagina ventral of cirrus pouch on both sides of the segment ..... *Cittotænia* (p. 170), 19

8. Pores unilateral; testicles unilateral, or nearly so, in median field.
Anoplocephala (p. 150), 11
Pores regularly or irregularly alternate; testicles extend across the median field (not shown as yet for *B. studeri* and *B. satyri*) ..... *Bertia* (p. 160), 14

9. Genital pores irregularly alternate with marked tendency to unilaterality; pedunculated round or elongate prostatic gland near ventral canal on pore side of segment; dorsal canal lies dorsal to dorso (? lateral) of ventral canal.
Andrya (p. 154), 26
Genital pores double; pedunculated prostatic gland absent; vagina ventral of right cirrus and dorsal of left cirrus ..... *Moniezia.*[1]

10. *Uterus single, transverse, but undulate, with asconspore or cornucopia-like egg pouches; genital pores single or double; testicles form a band in median field or are divided into two lateral groups, one in each lateral field* ..... *Thysanosoma.*[2]
Uterus single and transverse, or double, being represented by a cornucopia-like pouch on each side of the segment; genital pores irregularly alternate; testicles in two lateral groups and absent from median line ..... *Stilesia.*[3]

Anoplocephala.

11. *Head with posterior lobes; body may attain 8 to 25 mm. long by 3 to 15 mm. wide; head 2 to 3 mm. broad. Host: Horse* (Equus caballus) ..... *A. perfoliata.*
Head without posterior lobes 12

12. *Head 4 to 6 mm. broad; strobila 9 to 80 cm. long by 5 to 20 mm. broad. Host: Horse* (Equus caballus) *and Mule* (Equus asinus × caballus) ..... *A. plicata.*[4]
Head less than 1 mm. broad 13

13. Strobila 10 mm. long by 1.5 to 2.25 mm. broad; contains 10 to 28 segments; distal segments may become nearly as long as broad; genital glands confined to proximal third of worm; testicles 15 to 30 in each segment; cirrus pouch 0.48 mm. long. Host: European rabbit (*Lepus cuniculus*) and Mountain hare (*L. variabilis*) ..... *A. winerosa.*
Strobila attains 6 to 30 mm. long by 4 to 6 mm. broad; 35 to 53 segments present, the distal 4 to 8 completely filled with ova; testicles 60 to 100 in each segment; cirrus pouch attains 0.8 mm. in length. Host: Horse (Equus caballus).
A. mamillana (p. 153).
Strobila 10 to 16 cm. long by 6 to 8 mm. broad; 60 to 80 testicles present. Host: Arctomys, *sp* ..... *A. transversaria* (p. 154).

[1] 1891, *Moniezia*, R. BLANCHARD, Mém. Soc. zool. France, IV, p. 187. Type, *Tænia expansa*, Rudolphi, 1810.

For the species of this genus see Stiles & Hassall, 1893, A Revision of the Adult Cestodes of Cattle, Sheep, and Allied Animals, Bull. 4, Bureau of Animal Industry, U. S. Dept. Agriculture.

[2] 1835, *Thysanosoma*, DIESING, Med. Jahrb. d. öst. Staat. n. Folge, VII, pp. 105–111, pl. III. Type, *Thysanosoma actinioides*, Diesing, 1835.

For the species of this genus see Stiles in Stiles & Hassall, 1893, Bull. 4, Bureau of Animal Industry.

[3] 1893, *Stilesia*, RAILLIET, Traité de Zool. méd. et agric., I, pp. 277–278. Type, *Tænia globipunctata*, Rivolta, 1874.

For the species of this genus see Stiles in Stiles & Hassall, 1893, Bull. 4, Bureau of Animal Industry.

[4] Doubtful whether this specific term should stand, as it is antedated by *equina*, 1781, and *magna*, 1789.

Bertia.

14. Hosts: Rodents;[1] cirrus pouch distinctly muscular, prominent, with vesicula seminalis; receptaculum seminis round and prominent; pores very regularly alternate; calcareous corpuscles present or absent 15

Hosts: Primates and lemurs;[1] cirrus pouch?; calcareous corpuscles present 16

15. *Genital pores in posterior half of lateral margin; cirrus pouch about 0.5 mm. long; posterior segments show a tendency to become narrow and thick; strobila attains 33 mm. in length by 6 mm. in breadth, and contains about 90 segments, calcareous corpuscles not observed. Host: Yellow-haired porcupine* (Erethizon epixanthus) *and Canada porcupine* (E. dorsatus), *North America* ..... *B. americana* (p. 165)

Genital pores in about the middle of the lateral margin; cirrus pouch about 0.4 mm. long; posterior segments do not become narrow; strobila attains 23 to 47 mm. in length by 5 to 6.5 mm. in breadth, and contains 60 to 95 segments; calcareous corpuscles present. Host: Rabbit (*Lepus*, sp. ?), North America.

B. americana leporis (p. 167).

16. *Cirrus pouch not so prominent as vagina, and with but weak musculature; receptaculum seminis round to elongate and not very prominent; pores irregularly alternate; ovary confined to pore side of median field; uterus transverse with proximal and distal pouches* 17

Cirrus pouch very muscular; receptaculum seminis elongate; pores irregularly alternate; ovary extends to aporose portion of median field; uterus transverse with proximal and distal pouches; strobila 24 to 220 mm. long by 5 to 11 mm. broad, and contains 80 to 400 segments. Host: Flying lemur (Galeopithecus volans), India.

B. plastica (p. 164).

Cirrus pouch? vesicula seminalis?; uterus composed of 30 to 35 polyhedral packages. 18

17. *Strobila attains 140 mm. or more in length by 8 to 10 mm. in breadth. Host: Black howler* (Alouatta caraya), *Paraguay* ..... *B. mucronata* (p. 162).

Strobila attains 84 mm. or more in length by 6.5 mm in breadth. Host: Bonnet monkey (Macacus sinicus), *India* ..... *B. conferta* (p. 163).

18. *Strobila attains 130 mm. in length by 15 mm. in breadth by 2.5 mm. in thickness; genital pore alternates very regularly; ova 53 to 60 μ. Host: Chimpanzee* (Anthropopithecus troglodytes) ..... *B. studeri* (p. 161).

Strobila attains 245 mm. or more in length by 10 mm. in breadth by 2 mm. in thickness; pores irregularly alternate; cirrus pouch claviform; ova 35 to 38 μ by 30 to 32 μ. Host: Oran-utan (Simia satyrus) ..... *B. satyri* (p. 161).

Cittotænia.

19. Cirrus pouch muscular, generally pyriform, with distinct outline, and swollen proximally by the vesicula seminalis ..... Marmotæ-Group, 20

Cirrus pouch tubular, resembling the nozzle of a hose, of equal or nearly equal diameter throughout its entire length, and not swollen proximally by any prominent vesicula seminalis ..... Pectinata-Group, 23

20. Testicles arranged in a band extending across the median field 21

Testicles comparatively few in number, absent from median line, arranged in two triangular groups, one corresponding to each ovary; cirrus pouch small, 0.16 mm. long, scarcely reaching the longitudinal nerve; pores in distal part of lateral margin; female glands near ventral canal; dorsal canal dorsal or dorso-lateral of ventral canal; strobila attains 80 cm. in length by 10 mm. in breadth. Host: Common wild and tame rabbits (*Lepus cuniculus* and *L. cuniculus domesticus*), Europe ..... *C. ctenoides* (p. 179).

21. Testicles not confined to space between the ovaries 22

Testicles confined to distal portion of segment between ovaries; cirrus pouch about 0.5 mm. long by 0.17 mm. broad, crosses the canals; female glands some distance from

[1] Characters satisfactory for an analytical key are still lacking.

lateral canals; transverse uterus single with proximal and distal pouches; dorsal canal between ventral canal and nerve; strobila may attain 112 mm. long by 5 to 13 mm. broad. Host: Marmot (Arctomys marmota), *Europe. C. marmotæ* (p. 172).

22. Cirrus pouch very large and prominent, may attain 1.12 mm. long by 0.32 mm. broad; pores at or near distal corner of lateral margin; female glands not far removed from dorsal canal; several accessory ventral canals; strobila may attain 80 cm. long by 15 mm. broad. Host: Wild rabbit (*Lepus cuniculus*), Europe ..... *C. denticulata* (p. 174).

Cirrus pouch small, 0.24 mm. long; female glands considerably removed from dorsal canal; dorsal canal lateral or dorso-lateral of ventral canal; receptaculum seminis very large; segments imbricate; strobila attains 40 mm. long by 5.5 mm. broad. Host: Prairie gopher (Geomys bursarius), *North America.. C. præcoquis* (p. 181).

23. Cirrus pouch, about 1 mm. long, extends some distance median of longitudinal canals; testicles arranged in a band in distal portion of median field, extending beyond ovaries from canal to canal; ovary some distance from longitudinal canals; uterus single, with well-developed proximal and distal pouches; strobila attains 40 cm. in length by 8 to 10 mm. in breadth. Hosts: Common hare (*Lepus timidus*) and mountain hare (*L. variabilis*) Europe.

C. pectinata (p. 184).

Cirrus pouch not over 0.5 mm. long, extends scarcely median of lateral canals; uterus single or double in the same strobila. Hosts: *Lepus*, North America. 24

24. Testicles in two groups, one for each ovary, extending laterally of ovaries but absent from median field; strobila attains 57 mm. or more in length by 10 mm. in breadth. Host: Cottontail rabbit (*L. sylvaticus*) ..... *C. perplexa* (p. 189).

Testicles in a band confined to distal portion of median field between the ovaries; strobila attains 100 to 180 mm. in length by 10 mm. in breadth. Host: Cottontail rabbit (*L. sylvaticus*) and marsh hare (*L. palustris*).

C. variabilis (p. 190), 25.

25. Strobila nearly always more than 3 mm. broad; posterior flap of segments nearly straight; segments slightly imbricate; genital pore in about the middle of the lateral margin. Host: Cottontail rabbit (*L. sylvaticus*).

C. variabilis (p. 192).

Strobila nearly always more than 3 mm. broad; posterior flap of segments lobed; segments imbricate; genital pores generally in distal half of lateral margin. Host: Marsh hare (*L. palustris*)..... *C. variabilis imbricata* (p. 193).

Strobila rarely over 2 mm. broad; posterior flap straight; segments not imbricate; genital pores generally in distal portion of lateral margin, generally double, occasionally single. Host: Cottontail rabbit (*L. sylvaticus*).

C. variabilis angusta (p. 193).

Andrya (*European*).

26. Genital pores near posterior corner of segment; prostatic gland elongate; head about 1 mm. in diameter; testicles comparatively few in number, confined chiefly to aporose side of median field; cirrus pouch 0.32 to 0.34 mm. long; strobila attains 60 to 80 cm. in length by 5 mm. in breadth. Host: Common hare (*Lepus timidus*), Europe..... *A. rhopalocephala* (p. 155).

Genital pores in about the middle, or in the distal half of the lateral margin; prostatic gland round; head about 0.5 mm. in diameter; testicles about 50 in number, scattered through entire median field; cirrus pouch 0.4 to 0.48 mm. long; strobila attains 100 cm. in length by 8 mm. in breadth. Host: Wild rabbit (*Lepus cuniculus*), Europe..... *A. cuniculi* (p. 158).

Dipylidiinæ.

27. *Suckers unarmed* 28

Suckers armed with minute hooklets (with four exceptions known only in birds) 33

28. *Genital pores double* 29

Genital pores single, irregularly alternate or unilateral 31

29. *Two submedian ovaries in each segment* 30
One median ovary in each segment ..... *Amabilia.*[1]
30. *Several rows of hooks upon rostellum* ..... *Dipylidium.*[2]
A single row of hooks upon rostellum ..... *Cotugnia.*[3]
31. *Dorsal root of hooks much longer than ventral root or prong; ventral root very short; hooks 8 to 12 (rarely to 26) in number; known only in birds* ..... *Drepanidotænia.*[4]
Dorsal root of hooks about the same length as ventral root and prong 32
32. *Dorsal root shorter than prong or ventral root; hooks generally less than 20 in number (range from 10 to 26); genital pores unilateral or irregularly alternate; known only in birds* ..... *Dicranotænia.*[5]
Dorsal root longer than prong or ventral root; if rostellum is armed, there are 24 to 30 hooks present; genital pores unilateral (on left of segments); three testicles normally present in each segment; retractile rostellum armed with minute hooklets or rudimentary and unarmed; eggs with three envelopes; parasitic in man, chiroptera, insectivora, rodents, and insectivorous birds; larval stage in insects or myriapoda. *Hymenolepis.*[6]
33. Hooks on suckers arranged in circular rows on border; hooks on rostellum resemble a hammer in form and are arranged in a double row; with four exceptions known only in birds ..... *Davainea* (p. 194), 35.

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[1]1893, *Amabilia*, DIAMARE, Boll. Soc. Nat. Napoli, 1. ser., VII (1-2), p. 13. August 28, 1893. Type, *Tænia lamelligera*, Owen, 1835.

† 1896, *Diploposthe*, JACOBI, Zool. Anzeiger, XIX, No. 505, June 15, 1896, pp. 268-269. Type, *Tænia lævis*, Diesing.

See Stiles, 1896, Bull. 12, Bureau of Animal Industry, p. 31. From the diagnosis given by Jacobi I fail to see how *Diploposthe* differs from *Amabilia*.

[2]1863, *Dipylidium*, R. LEUCKART, Die menschlichen Parasiten, I, p. 400. Type, *Tænia elliptica*, Batsch, 1786 = *Tænia canina*, Linnæus, 1758.

1858, "*Alyselminthus*, ZEDER, 1800 pp.," of Weinland with *Tænia cucumerina*, Bloch, 1782 = *Tænia canina*, Linnæus, 1758, as type.

1884, *Microtænia*, SEDGWICK, as subgenus in CLAUS & SEDGWICK, Elementary Text-book of Zoology, I, p. 336. Type, *Tænia cucumerina*, Bloch, 1782 = *Tænia canina*, Linnæus, 1758.

For species and bibliography see Diamari's monograph (1893) Il Genere *Dipylidium*, Lkt., Atti R. Accad. Scienze fisische e matematiche, 2 ser., VI, No. 7, 31 pp., pls. I-III.

[3]1873, *Cotugnia*, DIAMARI, Boll. Soc. Nat. Napoli, 1. ser., VII (1-2), p. 11. August 28, 1893. Type, *Tænia digonopora*, Pasquale, 1890.

See Stiles, 1896, Bull. 12, Bureau of Animal Industry, p. 29.

[4]1892, *Drepanidotænia*, RAILLIET, Bull. Soc. zool. France, XVII, p. 116. Type, *Tænia lanceolata*, Bloch, 1782.

† 1896, *Choanotænia*, RAILLIET, Rec. méd. vét., 8 ser., III (5), March 15, 1896, p. 159. Type, *Tænia infundibuliformis*, Goeze, 1782.

For species and bibliography of this genus see Stiles, 1896, Bull. 12, Bureau of Animal Industry, pp. 36-45, 60-61.

[5]1892, *Dicranotænia*, RAILLIET, Bull. Soc. zool. France, XVII, p. 116. Type, *Tænia coronula*, Dujardin, 1845.

For species and bibliography of this genus see Stiles, 1896, Bull. 12, Bureau of Animal Industry, pp. 32-36.

[6]1858, *Hymenolepis*, WEINLAND, Human Cestoides, p. 49, 52. Type, *Tænia flavopunctata*, Weinland, 1858 = *Tænia diminuta*, Rudolphi, 1819.

1858, *Lepidotrias*, WEINLAND, as subgenus of *Hymenolepis*, Human Cestoides, p. 52. Type, *Tænia murina*, Dujardin, 1845, proposed by Weinland, but this subgenus includes the type of the genus.

For species and bibliography of the genus see R. Blanchard, 1891, Hist. zool. et méd. des Téniadés du genre *Hymenolepis*, Weinland. Paris. 112 pp., 22 figs.

Hooks on suckers arranged in several transverse rows; hooks of infundibulum very small (4 μ) arranged in a single row; known only in birds ..... *Ophryocotyle.*[1]

Hooks on suckers arranged in one median set and two lateral sets; hooks on rostellum provided with long dorsal root and arranged in a single row; known only in birds. *Echinocotyle.*[2]

Subfamily ?

34. *Anterior extremity of strobila expanded in form of a hammer* ..... *Fimbriaria.*[3]
Anterior segments become calciform and function as pseudoscolex ..... *Idiogenes.*[4]

Davainea.

35. *Found in birds; see Stiles, 1896,* [5] p. 45.
Found in mammals 36
36. Genital pores unilateral; a single egg in each egg capsule 37
Genital pores generally alternate; strobila attains 85 mm. or more in length by 3 mm. in breadth; suckers not invaginated; eggs grouped 3 to 15 in each egg capsule. Host: Eastern Jackass hare (*Lepus melanotis*) and Cottontail rabbit (*L. sylvaticus*) ..... *D. salmoni* (p. 198).
37. Suckers (always?) invaginated; strobila attains 105 mm. long by 3 mm. broad. Host: Arizona cottontail (*L. arizonæ*) ..... *D. retractilis* (p. 195).
Suckers not invaginated 38
38. *Rostellum armed with double row of about 90 hooks, 18 μ long; strobila attains 250 to 300 mm. long, composed of 500 to 600 segments. Host: Man* (Homo sapiens). *D. madagascariensis* (p. 194).
Rostellum large, armed with (?) a single row of numerous minute hooklets; suckers armed with 8 to 10 rows of hooks. Host: Common Indian Pangolin (Manis pentadactyla) ..... *D. contorta* (p. 195).

COMPENDIUM OF THE PARASITES ARRANGED ACCORDING TO THEIR HOSTS.

In the following list are given the hosts of the parasites discussed in this paper, so far as they are known to me. I have personally examined the species starred (*) for the hosts under which they are given. For the name of the collector in each case see text. The numbers given with the names of the hosts are those of von Linstow's Compendium and Nachtrag. The geographical distribution refers to the host. One

[1] 1870, *Ophryocotyle*, FRIIS, Videnskab. Meddel. fra den Naturhist. Foren. Kjobenhavn [aar 1869], 1870, pp. 121–124, pl. I. Type, *Ophryocotyle proteus*, Friis, 1870.

R. Blanchard gives the date as 1869, Braun gives it 1870. Original not at my disposal. For species see Stiles, 1896, Bull. 12, Bureau of Animal Industry, p. 56.

[2] 1891, *Echinocotyle*, R. BLANCHARD, Bull. Soc. zool. France, IV, p. 423. Type, *E. rosseteri*, R. Blanchard, 1891.

[3] 1802, *Fimbriaria*, FRÖLICH, Der Naturforscher, XXIX, pp. 13–14. Type, *Tænia malleus*, Goeze, 1782.

1850, *Rhynchotænia*, DIESING (as section or subgenus of *Tænia*), Systema Helminthum, I, p. 521. Type, *Tænia malleus*, Goeze, 1782.

1892, *Epision*, LINTON, Proc. U. S. Nat. Mus., XV, p. 100. Type, *Epision plicatus*, Linton, 1892.

[4] 1868, *Idiogenes*, KRABBE, Videns. Meddel. fra d. Naturhist. Foren. Kjobenhavn (for Aaret 1867), 1868, pp. 122–126. Type, *Idiogenes otidis*, KRABBE, 1868.

[5] Stiles, 1896, Report upon the Present Knowledge of the Tapeworms of Poultry, Bull. 12, Bureau of Animal Industry, U. S. Department of Agriculture.

or two parasites not discussed in this paper are included in the compendium for reasons obvious in each case.

I have elsewhere (1896) made a plea for the adoption of a modern system of nomenclature for the hosts, and have endeavored to introduce here the correct names for most of the hosts cited. In the main, Flower and Lydekker's Mammals Living and Extinct (1891) has been followed; in the few cases that I have departed from the names given in that work I have done so upon the advice of Dr. T. S. Palmer. In order to prevent confusion by this change in host names, I have added the names used by von Linstow in his compendium or by other authors in their writings, cross-referencing the synonyms to the proper name. It is impossible to give a monographic list of the genus *Lepus* and to establish the correct names of all the forms until that genus is revised by a specialist in mammalogy.

ALOUATTA CARAYA (Humboldt, 1811). Black Howler.
(*Stentor caraya*, Humboldt; 20. *Mycetes niger;* 31. *Cebus caraya*, Fischer).
(Southern Brazil, Paraguay, Bolivia.)
* *Bertia mucronata.*
Tænia megastoma.

ANTHROPOPITHECUS TROGLODYTES (Linnæus, 1758). Chimpanzee.
(2a. *Simia troglodytes; Troglodytes niger* Geoff.)
(Western and Central Equatorial Africa.)
Bertia studeri.

92. ARCTOMYS MARMOTA (Linnæus, 1758). Alpine Marmot.
(Mountains of southern Europe—Alps, Pyrenees, and Carpathians.)
* *Cittotænia marmotæ.*

92*b*. ARCTOMYS, sp.?
(Turkestan.)
Anoplocephala transversaria.

31. CEBUS CARAYA, Fischer vide ALOUATTA CARAYA.

30. CEBUS CAPUCINUS (Linnæus, 1758). Weeping Capuchin.
(Paraguay to United States of Colombia.)
"Tænia No. 2, Gottheil," p. 164.

248. EQUUS CABALLUS (Linnæus, 1758). Horse.
* *Anoplocephala mamillana.*
Anoplocephala perfoliata.
Anoplocephala plicata.
Anoplocephala plicata pediculata.
Anoplocephala plicata strangulata.

124. ERETHIZON DORSATUS (Linnæus, 1758). Canada Porcupine.
(Boreal region of eastern North America.)
* *Bertia americana.*
Tænia laticephala, Leidy.
? "*Tænia pectinata*" with unilateral pores=?, recorded by Cobbold, 1862.

ERETHIZON EPIXANTHUS, Brant. Yellow-haired Porcupine.
(Mountains of Western United States.)
* *Bertia americana.*

GALEOPITHECUS VOLANS (Linnæus, 1758). Flying Lemur, Common Colugo or Cobego.
(Sumatra, Borneo, Java, Malay Peninsula, Tenasserim, and Siam.)
Bertia plastica.

GEOMYS BURSARIUS (Shaw, 1800). Prairie Gopher.
(Upper Mississippi Valley, southward to southern Illinois, Missouri, and eastern Kansas.)
* *Cittotænia præcoquis.*

1. HOMO SAPIENS, Linnæus, 1758. Man.
Bothriocephalus cordatus.
**Bothriocephalus latus.*
Davainea madagascariensis
Dipylidium caninum.
Hymenolepis diminuta.
Hymenolepis murina.
Krabbea grandis.
**Tænia confusa.*
**Tænia saginata.*
**Tænia solium.*

12. INUUS CYNOMOLGUS vide MACACUS CYNOMOLGUS.

LEPUS AMERICANUS, Erxleben, 1777. Northern Hare.
(Wooded districts, New England to Minnesota, and south to Virginia, along the Alleghanies.)
? "*Tænia pectinata,*" reported by Curtice,[1] 1892, p. 232.

LEPUS ARIZONÆ, Allen, 1877. Arizona Cottontail.
(Arizona, southern Nevada, and desert region of southern California.)
**Davainea retractilis.*

137. LEPUS CUNICULUS. Common European Wild Rabbit.
Andrya cuniculi. See p. 155.
**Anoplocephala wimerosa.*
**Cittotænia ctenoides.*
**Cittotænia denticulata.*

137*a*. LEPUS CUNICULUS DOMESTICUS. Common Domesticated Rabbit.
**Cittotænia ctenoides.*
? "*Tænia pectinata,*"[1] reported by Curtice, 1892, p. 232.

LEPUS MELANOTIS, Mearns, 1890. Eastern Jackass Hare.
(Plains from Texas to Nebraska, west to Rocky Mountains.)
**Davainea salmoni.*

LEPUS PALUSTRIS, Bachman, 1837. Marsh Hare.
(Marshy lowlands of South Atlantic States, from North Carolina southward.)
**Cittotænia variabilis imbricata.*

138. LEPUS SYLVATICUS, Bachman, 1837. Cottontail.
(Eastern United States.)
**Cittotænia perplexa.*
**Cittotænia variabilis.*
**Cittotænia variabilis angusta.*
**Davainea salmoni.*

LEPUS TEXIANUS, Waterhouse, 1848. Black-Tailed Jack-Rabbit.
(Great Basin.)
"An undescribed *Tænia,*"[2] reported by Curtice, 1892, p. 233.

140. LEPUS TIMIDUS, Linnæus, 1758. Common European Hare.
(All parts of Europe except the north of Russia, the Scandinavian peninsula, and Ireland.)
? *Andrya cuniculi.* See p. 155.
**Andrya rhopalocephala.*
**Cittotænia pectinata.*

139. LEPUS VARIABILIS, Pallas, 1778. Mountain Hare.
(Northern Eurasia.)
**Anoplocephala wimerosa.*
**Cittotænia pectinata.*

[1] I am unable to trace this specimen, but most of Curtice's *T. pectinata* is *C. variabilis.*
[2] Impossible to tell definitely what species Curtice referred to, but possibly the parasite is *Davainea salmoni* and the host *L. melanotis.*

LEPUS, SP. ?
(Some North American species.)
**Bertia americana leporis.*

?LEPUS SP.? (?WASHINGTONI, S. F. Baird, 1855). Western Varying Hare.
(Puget Sound.)
**Cittotænia (?) variabilis.*

MACACUS CYNOMOLGUS (Linnæus, 1758). Crab-eating Macaque.
(12. *Inuus cynomolgus.*)
(Malay Peninsula and Philippine Archipelago.)
"*Tænia* No. 1, Gottheil." See p. 134.
"*Tænia* No. 2, Gottheil." See p. 164.

MACACUS SINICUS (Linnæus, 1771). Bonnet Monkey.
(Southern India.)
Bertia conferta.

MANIS PENTADACTYLA. Common Indian Pangolin.
(India and Ceylon.)
Davainea contorta.

20. MYCETES NIGER, vide ALOUATTA CARAYA.

3. PITHECUS SATYRUS, vide SIMIA SATYRUS.

SIMIA SATYRUS, Linnæus, 1758. Orang or Oran-Utan.
(3. *Pithecus satyrus.*)
(Sumatra and Borneo.)
Bertia satyri.

2*a*. SIMIA TROGLODYTES, vide ANTHROPOPITHECUS TROGLODYTES.

TROGLODYTES NIGER, vide ANTHROPOPITHECUS TROGLODYTES.

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EXPLANATION OF PLATES.

PLATE V.

Anoplocephala wimerosa and *Anoplocephala mamillana.*

FIGS. 1–7. *Anoplocephala wimerosa*, from the European Mountain Hare (*Lepus variabilis*). Drawn from specimens taken by R. Blanchard at Briançon, France.

1. Dorsal view of adult worm, No. 1363, U.S.N.M. Enlarged about 15 times. Zeiss, 4–a* 10.
2. Ventral view of head and proximal segments. Alcohol specimen. Enlarged about 15 times. Zeiss, 4–a* 10.
3. Lateral view of head and proximal segments. Alcohol specimen. Enlarged about 15 times. Zeiss, 4–a* 10.
4. Apex view of head. Alcohol specimen. Enlarged about 15 times. Zeiss, 4–a* 10.
5. Isolated segments showing testicles, cirrus, and female organs. Zeiss, 4–16.
6. Older segments with beginning uterus. Zeiss, 4–16.
7. Egg containing oncosphere surrounded by pyriform body. Zeiss, 4–4.
8. *Anoplocephala mamillana*, from the horse (*Equus caballus*). Combined from Nos. 1368–1369, U.S.N.M., taken by Hassall in London, England. Enlarged about 15 times. Zeiss, 4–a* 10.

Drawn by Haines.

PLATE VI.

Anoplocephala mamillana and *Anoplocephala transversaria.*

FIGS. 1–3. *Anoplocephala mamillana*, from the Horse (*Equus caballus*).

1. Male organs: *cl. g.*, genital cloaca; *ci.*, cirrus; *p. g.*, genital papilla; *p. d. c.*, cirrus-pouch; *v. s.*, vesicula seminalis; *v. d.*, vas deferens; *t.*, testicles; *v. e.*, vas efferens. After Zschokke, 1889, Pl. I, fig. 10.
2. Female organs: *cl. g.*, genital cloaca; *p. g.*, genital papilla; *o. f.*, vulva; *va.*, vagina; *rec. s.*, receptaculum seminis; *v. sem.*, seminal canal; *g. e. x.*, collecting canal for half of the ovary; *g. d.*, common oviduct; *v. dt.*, vitello-duct; *gl. v.*, vitellogene gland; *gl. g.*, ovary; *gl. c.*, shell-gland; *ov. d.*, oviduct; *ut.*, uterus. After Zschokke, 1889, Pl. I, fig. 11.
3. Egg with three shells. After Zschokke, 1889, Pl. I, fig. 14.

4–7. *Anoplocephala transversaria* from *Arctomys* sp.

4. Male organs: Letters same as for fig. 1. After Zschokke, 1889, Pl. I, fig. 17.
5. Female organs: Letters same as for fig. 2. After Zschokke, 1889, Pl. I, fig. 19.
6. Head and proximal segments. After Zschokke, 1889, Pl. I, fig. 15.
7. Egg with three shells. After Zschokke, 1889, Pl. I, fig. 20.

Drawn by Haines.

PLATE VII.

Andrya rhopalocephala.

FIGS. 1–7. *Andrya rhopalocephala*, from the European Hare (*Lepus timidus*).

1. Strobila with head, natural size. No. 1379, U.S.N.M.
2. Three views of head, enlarged about 15 times. No. 1379, U.S.N.M.

FIG. 3. Two views of head, enlarged. After Riehm, 1881, Pl. V, fig. 1a-b.

4. A young segment showing testicles in the aporose portion of median field; the cirrus-pouch and vagina are becoming differentiated, and the anlage of the female glands is distinct; the anlage of the receptaculum connects the anlage of the female glands with the vagina. No. 1484, U.S.N.M.

5. An older segment; the testicles are larger; cirrus-pouch, vas deferens, and the elongate prostatic gland are distinct; the ovary, vitellogene gland, and receptaculum seminis are well developed; the latter is connected with the genital pore by the vagina. No. 1484, U.S.N.M.

6. A still older segment; of the male organs, the cirrus-pouch and a portion of the vas deferens are still visible; of the female organs, the glands have entirely disappeared, the receptaculum seminis and vagina are still preserved, while the developing uterus has assumed the form of a network. No. 1484, U.S.N.M.

7. A somewhat older segment, in which the cirrus-pouch and the receptaculum seminis are still visible; the network of the uterus is much more distinct. No. 1484, U.S.N.M.

FIGS. 1-2 and 4-7 are drawn from Riehm's cotypes, taken in Saxony, but very poorly preserved.

N. B.—As the statements regarding the uterus are made upon poorly preserved material, they should be taken with reserve until confirmed by an examination of freshly preserved specimens.

Drawn by Haines.

PLATE VIII.

Andrya rhopalocephala and *Andrya cuniculi.*

FIGS. 1-3. *Andrya rhopalocephala*, from the European Hare (*Lepus timidus*).

1. A gravid segment showing cirrus-pouch, receptaculum seminis, and the uterus; the latter has lost its net-like structure. No. 1484, U.S.N.M.

2. Riehm's original figure. The segment shows: *u.*, longitudinal nerve; *E.*, ventral canals, with transverse canal at distal end of the segment; *t.*, testicles; *e.*, ovary; *d.*, vitellogene gland; *s.*, shell-gland; *r. s.*, receptaculum seminis; *v.*, vulva and vagina; *c. b.*, cirrus-pouch; *v. s.*, vesicula seminalis; *v. d.*, vas deferens; *p.*, elongate prostata; *u.*, uterus. After Riehm, 1881, Pl. VI, fig. 1.

3. Egg. After Riehm, 1881, Pl. V, fig. 18.

4-8. *Andrya cuniculi*, from European Wild Rabbit (*Lepus cuniculus*).

4. Head and neck. After Riehm, 1881, Pl. V, fig. 2.

5. Segment showing: *E.*, ventral canals, connected by transverse canals; *t.*, testicles; *e.*, ovary; *d.*, vitellogene gland; *s.*, shell-gland; *r. s.*, receptaculum seminis; *v. d.*, vas deferens; *p.*, round prostata; *l. m.*, *r. m.*, longitudinal and circular muscles of the cirrus-pouch (*c. b.*); *v. s.*, vesicula seminalis; *v.*, vagina. After Riehm, 1881, Pl. VI, fig. 3.

6-8. Segments in three different stages of development. Drawn from one of Riehm's original specimens labelled "*Tænia rhopalocephala*" from "*Lepus timidus*," see p. 155. No. 1377, U.S.N.M., poorly preserved.

Drawn by Haines.

PLATE IX.

Andrya cuniculi; Bertia studeri; Bertia mucronata; Bertia conferta.

FIG. 1. *Andrya cuniculi*, gravid segment showing cirrus-pouch, receptaculum seminis, and uterus with eggs. No. 1377, U.S.N.M.

2-3. *Bertia studeri*, from the Chimpanzee (*Anthropopithecus troglodytes*).

FIG. 2. Strobila with head. After R. Blanchard, 1891A, fig. 2.

3. Three specimens of the pyriform body of the egg. After R. Blanchard, 1891A, fig. 4.

4–5. *Bertia mucronata*, from the Black Howler (*Alouatta caraya*).

4. Tranverse section of segment at genital pore: *H. N.*, lateral nerve trunk; *N. N.*, ventral accessory lateral nerve; *Ex. H.*, ventral canal; *Ex. N.*, dorsal canal; *Ut.*, uterus; *Mi. S.*, middle layer; *R. S.*, cortical layer; *M. tr.*, transverse muscles; *M. l.*, transverse section of longitudinal muscles; *Ov.*, ovary; *Ds.*, vitellogene gland; *El.*, oviduct; *E. Vg.*, "Excavatio vaginae;" *Kl.*, cloaca; *Pr. g.*, genital pore; *Vd. E.*, end portion of vas deferens; *Vg.*, vagina; *V. d.*, vas deferens; *Rec. s.*, receptaculum seminis; *Sblg.*, duct of receptaculum seminis; *Sd.*, shell-gland; *Sbcut.*, subcuticula; *Ho.*, testicles; *Cut.*, cuticle. After Meyner, 1895, Pl. I, fig. 3.

5. Ventral view of segment from one of Meyner's cotypes. No. 1483, U.S.N.M.

6. *Bertia conferta*, from the Bonnet Monkey (*Macacus sinicus*). Transverse section. After Meyner, 1895, Pl. II, fig. 9. For lettering see fig. 4.

Drawn by Haines.

PLATE X.

Bertia americana; Bertia americana leporis.

FIGS. 1–10. *Bertia americana*, from *Erethizon*.

1. Specimen from the Yellow-Haired Porcupine (*Erethizon epixanthus*). Natural size.

2. Specimen from the Canada Porcupine (*Erethizon dorsatus*). Natural size. After Curtice, unpublished.

3–5. Three enlarged views of head. Specimen from *E. epixanthus*. Zeiss, 4–a* 10.

6. Enlarged view of head, after Curtice, unpublished. Specimen from *E. dorsatus*.

7. Dorsal view of anterior portion of strobila from *E. epixanthus*. The figure is combined from a specimen mounted whole, and from several longitudinal and transverse sections. The head is retracted; dorsal canal is between ventral canal and nerve; female anlage appears in second segment; testicles in third segment, and round receptaculum seminis in fourth segment. The testicles become more numerous and the female glands gradually shift position to the right or left of the median line according to the position of genital pore. Zeiss, 4–a*

8. Diagrammatic transverse section of a very young segment; the dorsal canals are connected with the transverse canal; the female anlage appears in the median line. Host: *E. epixanthus*.

9. Transverse section of segments of a specimen from *E. epixanthus*. Zeiss, 4–16.

10. Gravid segment. Host: *E. epixanthus*. Zeiss, 4–a* 10.

11–15. *Bertia americana leporis*, from *Lepus* sp.

11. Strobila, natural size. No. 1171, U.S.N.M.

12. Head. No. 1170a, U.S.N.M. Zeiss, 4–a* 10.

13. Head. No. 1176a, U.S.N.M. Zeiss, 4–a* 10.

14. Dorsal view of young segments showing nerves, dorsal and ventral canals, cirrus, cirrus-pouch, vas deferens, testicles, receptaculum seminis, and very indistinct anlage of female glands. No. 1171, U.S.N.M. Zeiss, 4–a* 10.

15. Slightly older segments. No. 1170, U.S.N.M. Zeiss, 4–a* 10.

N. B.—All of these figures (except 2 and 6) were made from rather poorly preserved material.

Drawn by Haines.

PLATE XI.

Cittotænia marmotæ, from the Alpine Marmot (*Arctomys marmota*).

FIG. 1. Strobila, natural size.

2–4. Three views of head. Zeiss, 4–a* 10.

5. Enlarged dorsal view of strobila, mounted whole, showing internal anatomy. No. 1370, U.S.N.M.

Attention should be directed to the sudden development and equally sudden atrophy of the ovarian tubules, to the lateral growth between the ovary and lateral canal, and to the form of the uterus and the cirrus-pouch.

6. Diagrammatic transverse section of segment to show topographical anatomy: *P.*, cirrus; *V.*, vagina; *N.*, nerve; *D. C.*, dorsal canal; *V. C.*, ventral canal.

7–8. Two greatly enlarged figures, dorsal view, showing anatomy of segments. Fig. 7 after Stiles (in Stiles & Hassall, 1893, Pl. VII, fig. 6).

All figures were prepared from specimens collected at Briançon, France, by R. Blanchard.

Drawn by Haines.

PLATE XII.

Cittotænia marmotæ and *Cittotænia denticulata.*

FIGS. 1–2. *Cittotænia marmotæ*, from the Alpine Marmot (*Arctomys marmotæ*).

1. Dorsal view of gravid segment. Zeiss, 4–a* 10.

2. Oncosphere in the pyriform apparatus, escaping from the outer eggshell. Greatly enlarged.

3–8. *Cittotænia denticulata*, from European Wild Rabbit (*Lepus cuniculus*).

3. Strobila, natural size. No. 1328, U.S.N.M., one of Riehm's cotypes of *Dipylidium latissimum*. For figures of Rudolphi's cotypes of *Tænia denticulata* see Stiles (in Stiles & Hassall, 1893, Pl. V, figs. 4–7).

4. Head and anterior portion. After Riehm, 1881, Pl. V, fig. 5.

5. Lateral border of segments showing the gradual development of the cirrus. The numbers refer to the segments. After R. Blanchard, 1891B, fig. 22.

6. Injected excretory system. After Riehm, 1881, Pl. V, fig. 15.

7. Transverse section (diagrammatic) of segment to show topographical anatomy. Testicles are dorsal, accessory excretory canals ventral.

8. Ventral view of segment, showing cirrus, cirrus-pouch, vas deferens, testicles, ovaries, vitellogene glands, vagina, dorsal and larger ventral canals. No. 1328b, U.S.N.M. Zeiss, 4–a* 10.

Drawn by Haines.

PLATE XIII.

Cittotænia denticulata, from the European Wild Rabbit (*Lepus cuniculus*).

FIG. 1. Half of segment to show the anatomy: *rc.*, retractor muscle of the cirrus-pouch; *v. d.*, vas deferens; *p.*, prostata; *r m''.*, inner layer of circular muscles of the cirrus-pouch; *l m.*, longitudinal muscles; *r m'.*, outer layer of circular muscles; *sp.*, spongy connective tissue; *c.*, cirrus; *v.*, vagina; *n.*, longitudinal nerve; *x.*, dorsal canal; *E.*, ventral canal system; *rs.*, receptaculum seminis; *d.*, vitellogene gland; *s.*, shell-gland; *e.*, ovary; *u.*, uterus; *t.*, testicles. After Riehm, 1881, Pl. VI, fig. 2.

The topography is not well preserved, but this is probably a dorsal view, as is shown by the position of the dorsal canal. If this interpretation is correct, the vagina and vas deferens should run over the canals and nerves instead of under, as given in the figure. See Pl. XII, fig. 7.

FIG. 2. Ventral view of gravid segment. The peculiar folds of the uterus should attract attention. No. 328f, U.S.N.M., one of Riehm's cotypes of *Dipylidium latissimum*.

3a–h. Oncosphere, pyriform body, and middle and outer envelopes of the eggs. After R. Blanchard, 1891B, fig. 25.

Drawn by Haines.

PLATE XIV.

Cittotænia ctenoides, from European Wild Rabbit (*Lepus cuniculus*).

FIG. 1. Strobila, natural size, from one of Riehm's original specimens.

2. Head. Zeiss, 4–a * 10.

3. Head with dorsal and ventral excretory canals. After Riehm, 1881, Pl. V fig. 13.

4. Posterior segments with injected excretory system. After Riehm, 1881, Pl. V, fig. 16.

5. Half of segment to show the anatomy: *v d.*, vas deferens; *v s.*, vesicula seminalis; *cb.*, cirrus-pouch; *v.*, vagina; *ut.*, uterus; *n.*, nerve; *x.*, dorsal canal; *E.*, ventral canal with transverse canal; *s.*, shell-gland; *d.*, vitellogene gland; *t.*, testicles; *o.*, ovary; *r. s.*, receptaculum seminis. After Riehm, 1881, Pl. VI, fig. 5.

It is not clear whether this is a dorsal or ventral view; probably it is intended as dorsal; for correct topography see fig. 7.

6. Diagrammatic transverse section of segment; dorsal canal dorsal (in some segments dorso-lateral) of ventral canal; genital canals pass dorsally of nerve and longitudinal canals.

7. Segments showing position of the testicles. No. 1329a, U.S.N.M., from the domesticated rabbit. Zeiss, 4–a * 10.

8. A gravid segment showing uterus, two vaginæ, and two cirrus-pouches.

Drawn by Haines.

PLATE XV.

Cittotænia præcoquis, from the Prairie Gopher (*Geomys bursarius*).

FIGS. 1–2. Anterior portion of strobila (divided), showing the rapid development of the organs. No. 1079, U.S.N.M. Zeiss, 4–a* 10.

3. Three segments more highly magnified. No. 1079, U.S.N.M. Zeiss, 4–16.

4. Older segment. No. 1079, U.S.N.M. Zeiss, 4–16.

5. Transverse section of gravid segment at the pores, to show the anatomy. Attention should be directed to the very large receptaculum seminis.

6. Transverse section in another plane. The testicles extend further ventrad and the uterus is absent in the median line.

Drawn by Haines.

PLATE XVI.

Cittotænia pectinata, from European Mountain Hare (*Lepus variabilis*).

FIGS. 1–2. Enlarged view of strobila showing the gradual development of all of the organs. Ventral view. Specimen No. ——, U.S.N.M., collected by R. Blanchard in France.

Drawn by Haines.

PLATE XVII.

Cittotænia pectinata, from European Mountain Hare (*Lepus variabilis*) and European Hare (*Lepus timidus*).

FIG. 1. Continuation of Plate XVI, figs. 1–2, a few contracted segments omitted.

2. Strobila, natural size. One of Riehm's original specimens from the European Hare (*Lepus timidus*).

Drawn by Haines.

PLATE XVIII.

Cittotænia perplexa, from the Cottontail Rabbit (*Lepus sylvaticus*).

FIG. 1. Strobila with head, natural size. No. 1126, U.S.N.M.
2. Anterior portion of strobila enlarged to show the general appearance. No. 1138, U.S.N.M. Zeiss, 4–a* 5.
3. Ventral view of a single segment, showing nerves, canals, cirrus-pouch, vasa deferentia, testicles arranged in two groups, single uterus, two ovaries and vitellogene glands. No. 1131, U.S.N.M.

Drawn by Haines.

PLATE XIX.

Cittotænia variabilis; Cittotænia variabilis angusta.

FIGS. 1–12. *Cittotænia variabilis*, from the Cottontail Rabbit (*Lepus sylvaticus*).
1. Strobila, natural size.
2–7. Six views of heads.
8. Very young specimen.
9. Very young specimen with beginning segmentation. No. 1373.7, U.S.N.M.
10. Ventral view of segment in which uterus is not developed. No. 1162, U.S.N.M. Zeiss, 4–a* 10.
11. Ventral view of segment with single uterus. No. 1207, U.S.N.M. Zeiss, 4–a* 10.
12. Ventral view of segment with two uteri, only one of which is well developed. No. 1162, U.S.N.M. Zeiss, 4–a* 10.

13–14. *Cittotænia variabilis angusta*, from the Cottontail Rabbit (*Lepus sylvaticus*). Two strobilæ, natural size. For a figure of segments from fig. 14 (No. 119, U.S.N.M.), showing both double and single genital pores, see Stiles, 1895.

Drawn by Haines.

PLATE XX.

Cittotænia variabilis, from the Cottontail Rabbit (*Lepus sylvaticus*).

FIGS. 1–5. Segments showing variations. All ventral views, except fig 1. Nos. 1154, 1122, 1125, 1127, 1152, U.S.N.M. Enlarged about 15 times. Zeiss, 4–a* 10.

Drawn by Haines.

PLATE XXI.

Davainea retractilis, from the Arizona Cottontail Rabbit (*Lepus arizonæ*).

FIG. 1. Head enlarged. No. 1195, U.S.N.M. Zeiss, 4–16.
2. Retracted sucker of same, greatly enlarged.
3. Segments showing unilateral pores, longitudinal nerves and canals, and median female anlage. No. 1192, U.S.N.M. Zeiss, 4–16.
4. Older segments of same strobila, showing testicles.
5. Gravid segment showing one egg in each egg capsule. No. 1188, U.S.N.M.
6. Egg capsule with egg.

Drawn by Haines from poorly preserved specimens.

PLATE XXII.

Davainea retractilis; *Davainea contorta; Davainea salmoni.*

FIG. 1. *Davainea retractilis*, from the Arizona Cottontail Rabbit (*Lepus arizonæ*). Transverse section through gravid segment. Zeiss, 4–16.
2. Segment of *Davainea contorta*, from the Common Indian Pangolin (*Manis pentadactyla*): *h.*, testicle; *u.*, uterus: *ve.*, vas efferens; *vd.*, vas deferens; *ci.*, cirrus; *v.*, vagina; *k.*, ovary; *d.*, vitellogene gland. After Zschokke, 1895, fig. 2.

FIGS. 3–4. *Davainea salmoni*, from the Cottontail Rabbit (*Lepus sylvaticus*).
3. Longitudinal section through very young specimen, showing the rostellum with hooks and four longitudinal canals. Zeiss, 4–8.
4. Gravid segment, dorsal view, showing longitudinal nerve and canals, cirrus pouch, vas deferens, vagina, and numerous egg capsules. No. 1104, U.S.N.M. Zeiss, 4–a* 5.
Drawn by Haines.

PLATE XXIII.

Davainea salmoni, from the Cottontail Rabbit (*Lepus sylvaticus*) and the Eastern Jackass Hare (*Lepus melanotis*).

FIG. 1. Strobila, natural size.
2–5. Four views of head. Alcohol specimens. Enlarged about 15 times. Zeiss, 4–a* 10.
6. A portion of the double row of hooks on the rostellum. Greatly enlarged.
7. View of hooks on the suckers in somewhat contracted condition. Greatly enlarged.
8. Another view of hooks on the suckers. No. 1428, B.A.I.
9. Egg capsule with 5 eggs. Zeiss, 4–4.
Drawn by Haines.

PLATE XXIV.

Davainea salmoni, from the Eastern Jackass Hare (*Lepus melanotis*).

FIGS. 1–2. Dorsal view of segments in different stages, showing longitudinal nerves and canals, cirrus-pouch, vas deferens, testicles, vagina, and female glands. No. 1196, U.S.N.M. Zeiss, 4–16.
Drawn by Haines.

PLATE XXV.

Davainea salmoni, from the Cottontail Rabbit (*Lepus sylvaticus*).

FIGS. 1–11. Various young stages found in the intestine of the Cottontail Rabbit (*Lepus sylvaticus*). None of the forms show segmentation, but several figures show the surrounding membrane, evidently pointing to a recent infection.

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[Italicized figures (*215, 220*, etc.) refer to the more important references.]

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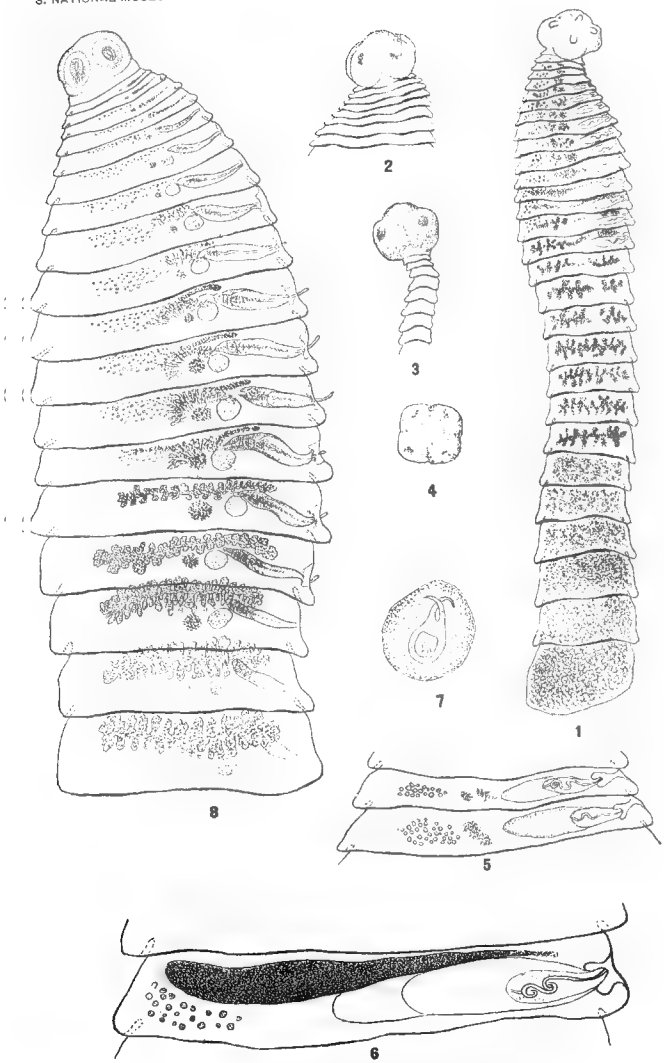
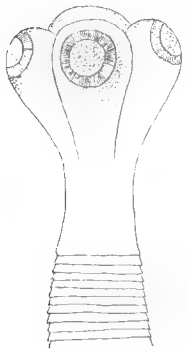


ANOPLOCEPHALINE TAPEWORMS FROM THE EUROPEAN MOUNTAIN HARE AND THE HORSE.

FOR EXPLANATION OF PLATE SEE PAGE 226.



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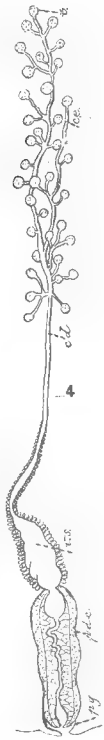

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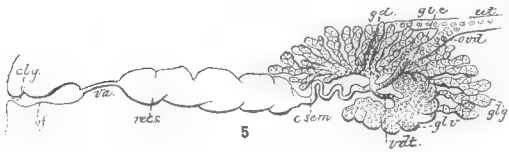

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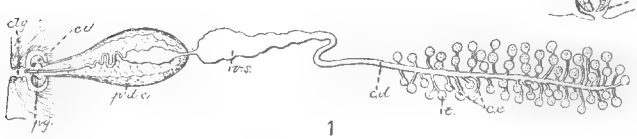

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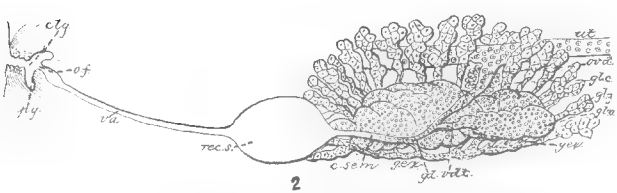
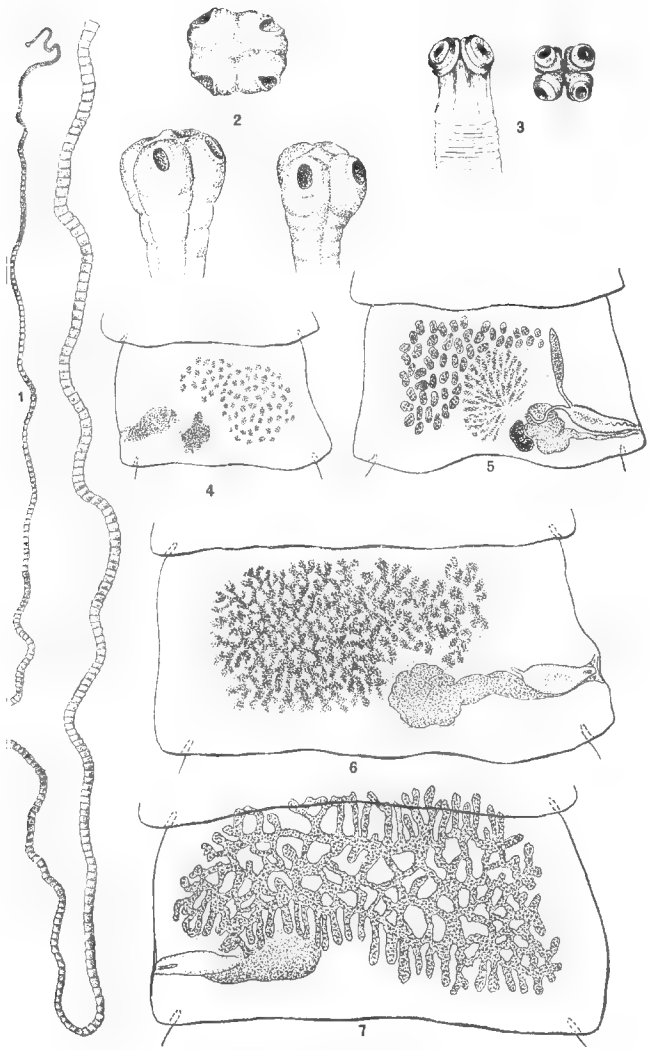


2

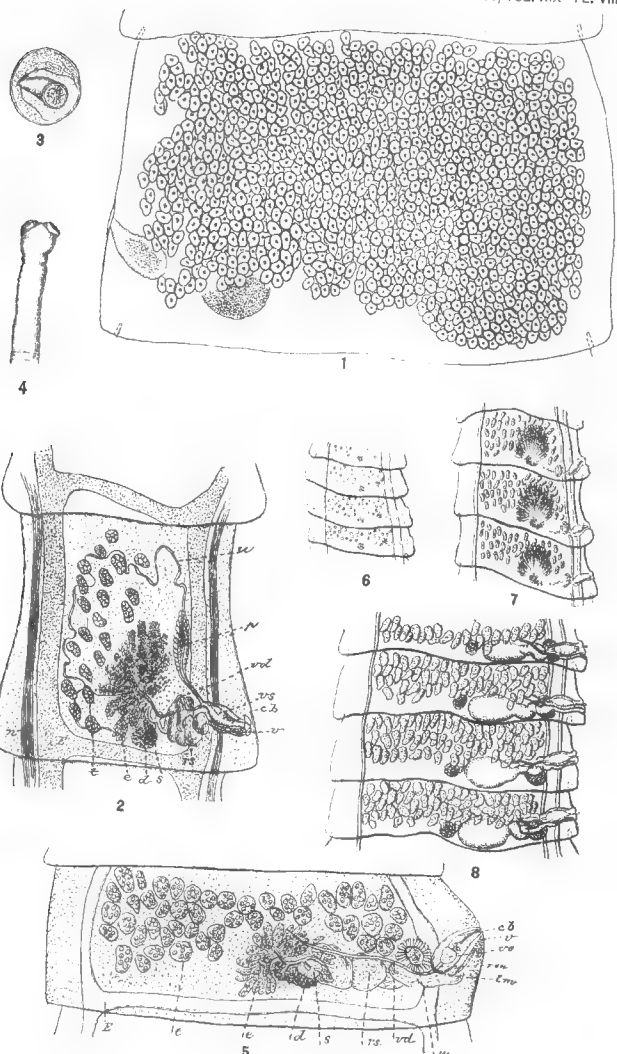
ANOPLOCEPHALINE TAPEWORMS FROM THE HORSE AND THE MARMOT.

FOR EXPLANATION OF PLATE SEE PAGE 226.



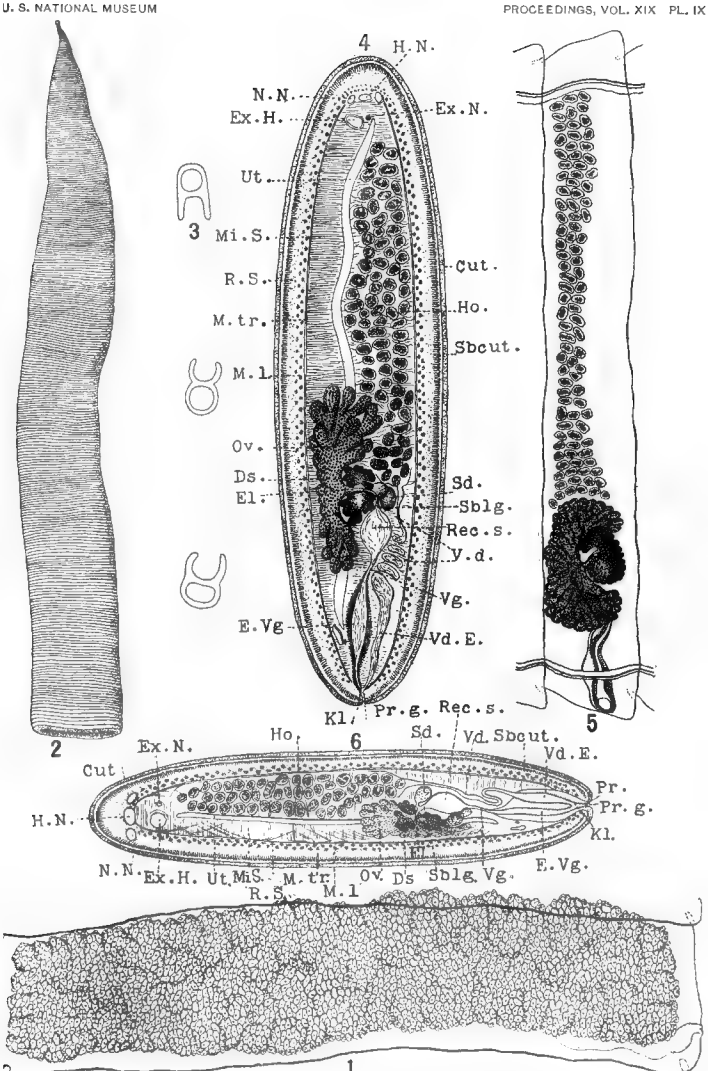
ANOPLOCEPHALINE TAPEWORM FROM THE EUROPEAN HARE.

FOR EXPLANATION OF PLATE SEE PAGE 226.



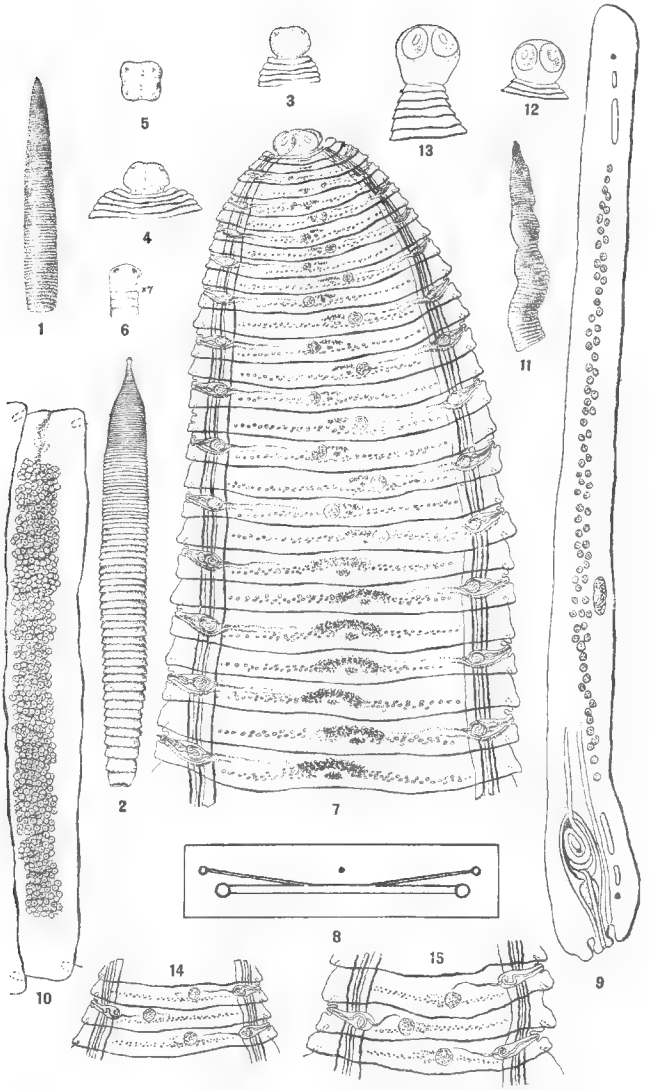
ANOPLOCEPHALINE TAPEWORM FROM THE EUROPEAN HARE AND THE EUROPEAN WILD RABBIT.

FOR EXPLANATION OF PLATE SEE PAGE 227.



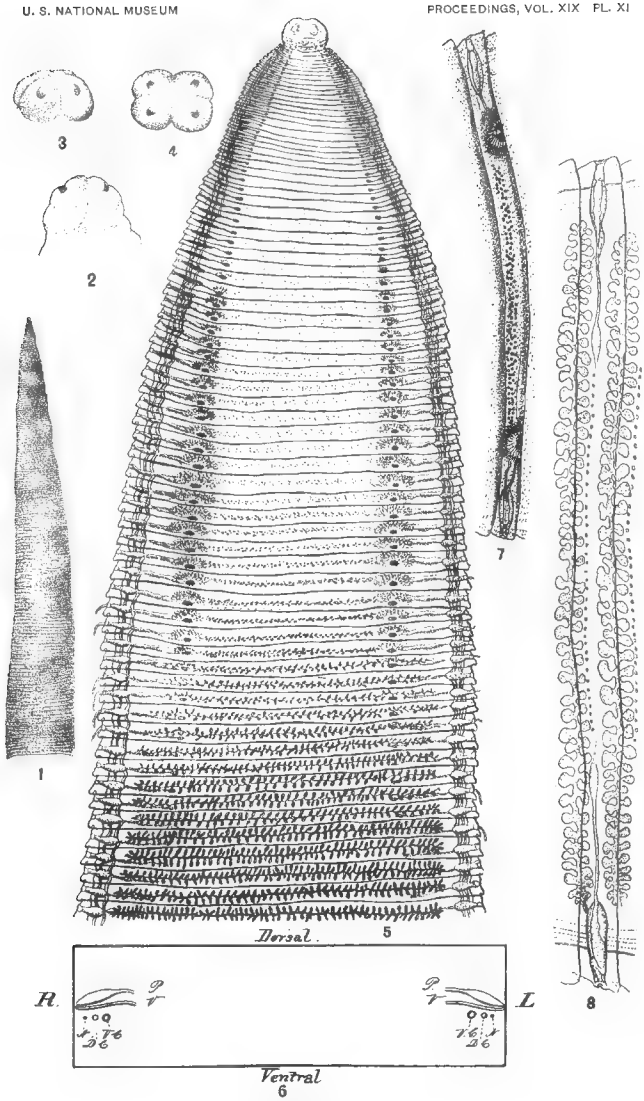
NOPLOCEPHALINE TAPEWORMS FROM THE EUROPEAN HARE, THE CHIMPANZEE, THE BLACK HOWLER, AND THE BONNET MONKEY.

FOR EXPLANATION OF PLATE SEE PAGE 227.



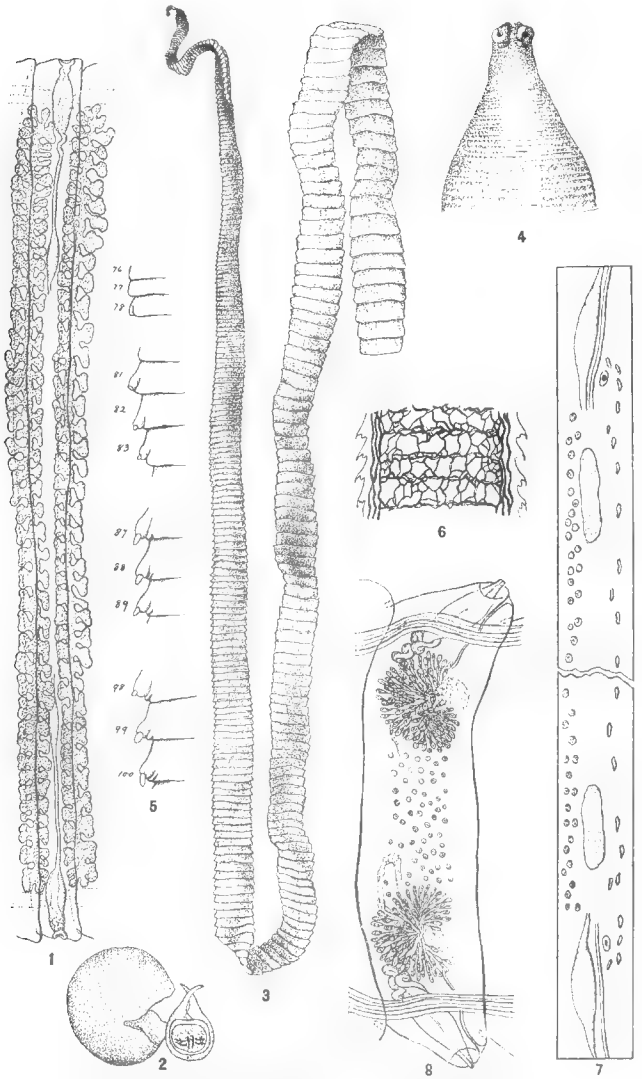
ANOPLOCEPHALINE TAPEWORMS FROM PORCUPINES AND HARES.

FOR EXPLANATION OF PLATE SEE PAGE 228



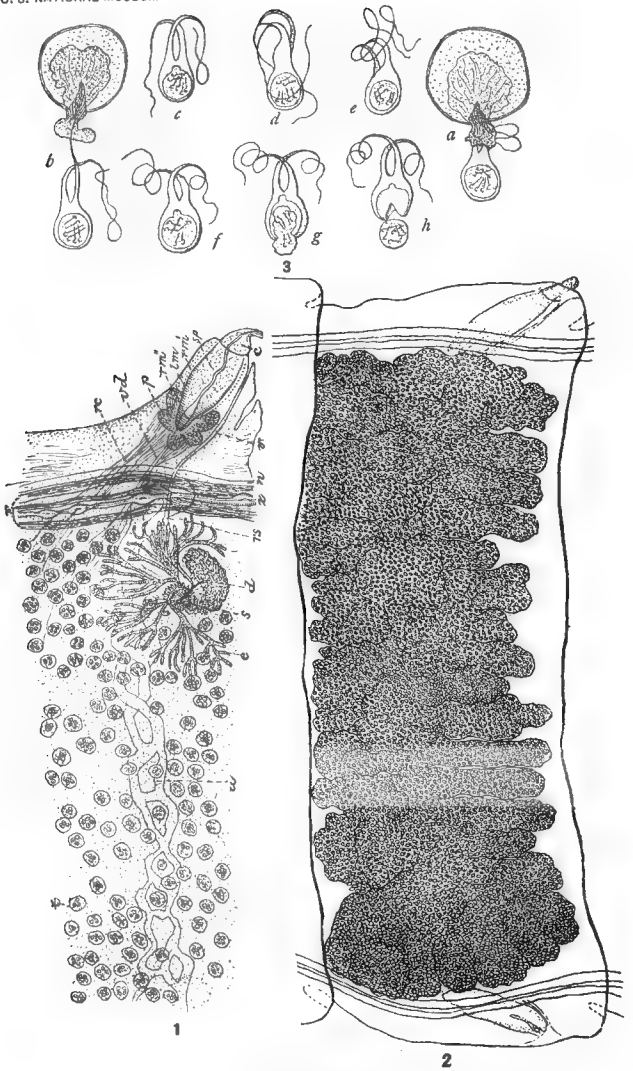
ANOPLOCEPHALINE TAPEWORM FROM THE ALPINE MARMOT.

FOR EXPLANATION OF PLATE SEE PAGE 229.



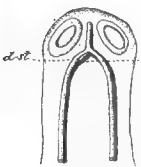
ANOPLOCEPHALINE TAPEWORMS FROM THE ALPINE MARMOT AND THE EUROPEAN WILD RABBIT.

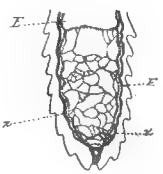
FOR EXPLANATION OF PLATE SEE PAGE 229.

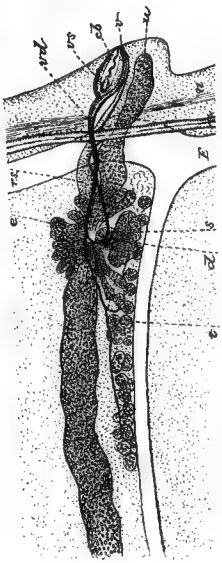


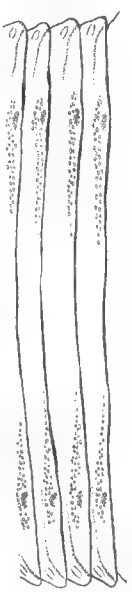
ANOPLOCEPHALINE TAPEWORM FROM THE EUROPEAN WILD RABBIT.

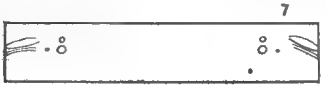
FOR EXPLANATION OF PLATE SEE PAGE 229.

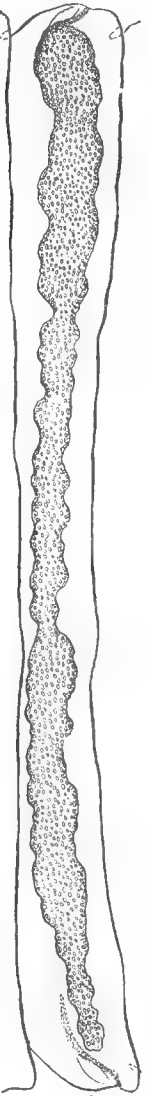






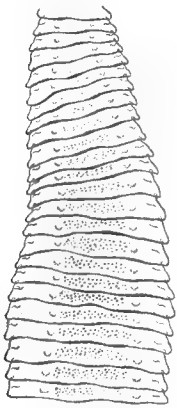






1 2 3 4 5 6 7 8

ANOPLOCEPHALINE TAPEWORM FROM THE EUROPEAN WILD RABBIT.



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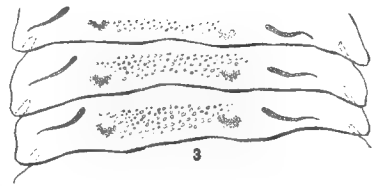

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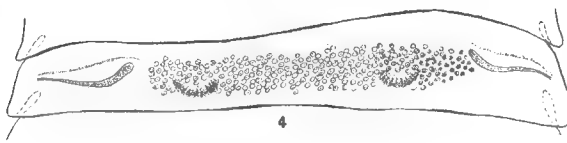

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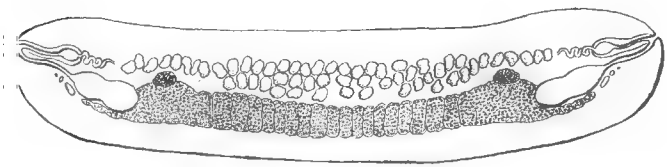

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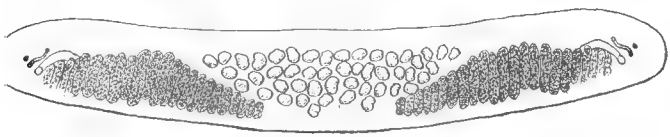
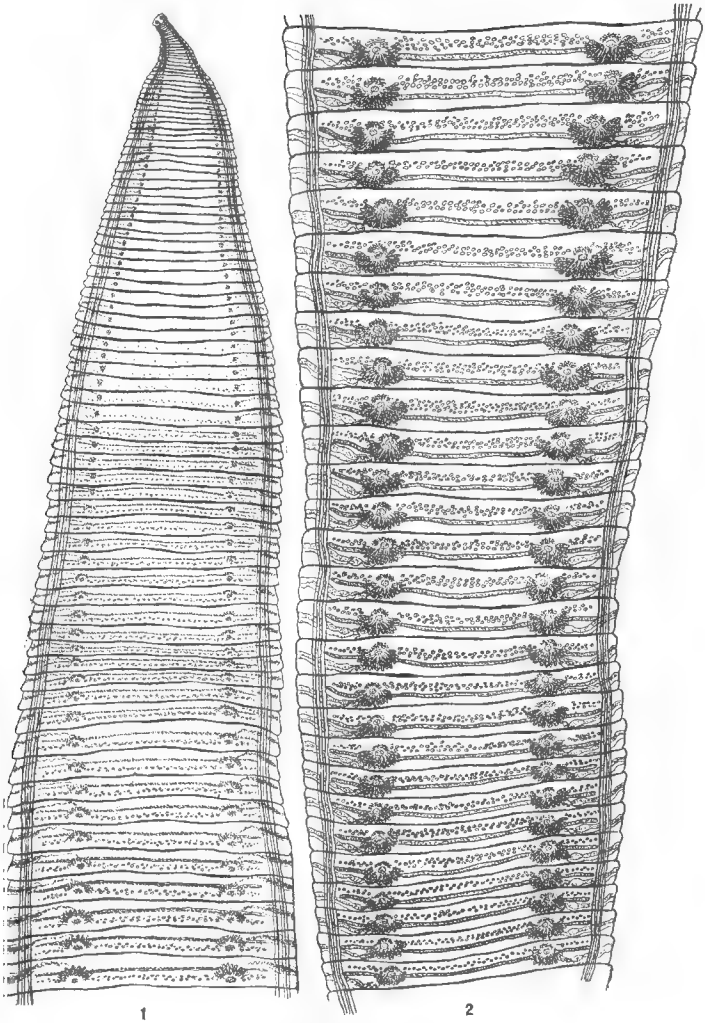


6

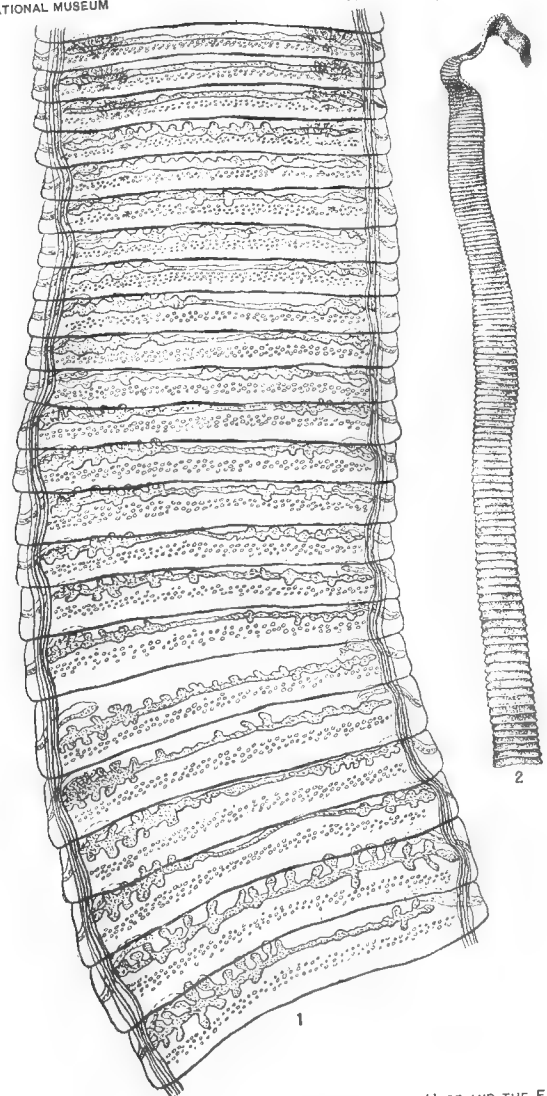
ANOPLOCEPHALINE TAPEWORM FROM THE PRAIRIE GOPHER.

FOR EXPLANATION OF PLATE SEE PAGE 230.



ANOPLOCEPHALINE TAPEWORM FROM THE EUROPEAN MOUNTAIN HARE.

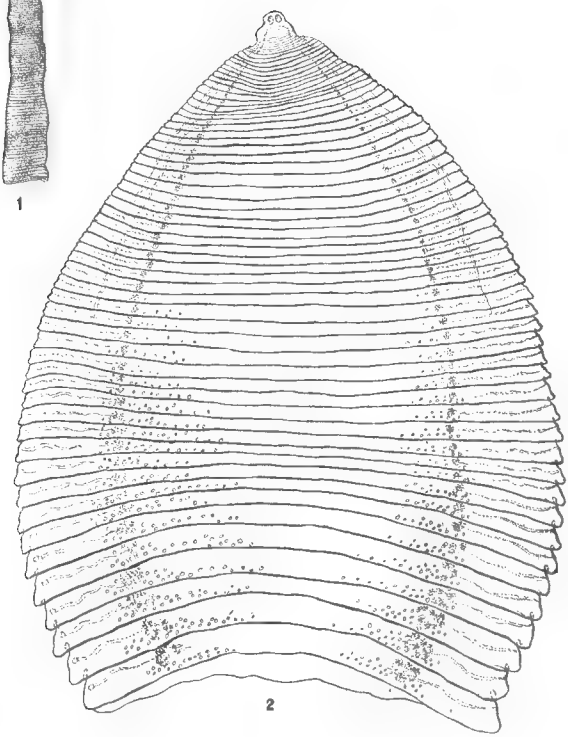
FOR EXPLANATION OF PLATE SEE PAGE 230.



ANOPLOCEPHALINE TAPEWORM FROM THE EUROPEAN MOUNTAIN HARE AND THE EUROPEAN HARE.

FOR EXPLANATION OF PLATE SEE PAGE 230.

1



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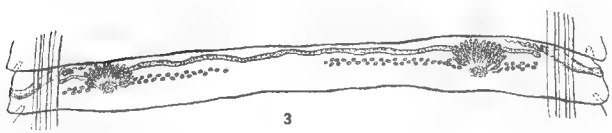
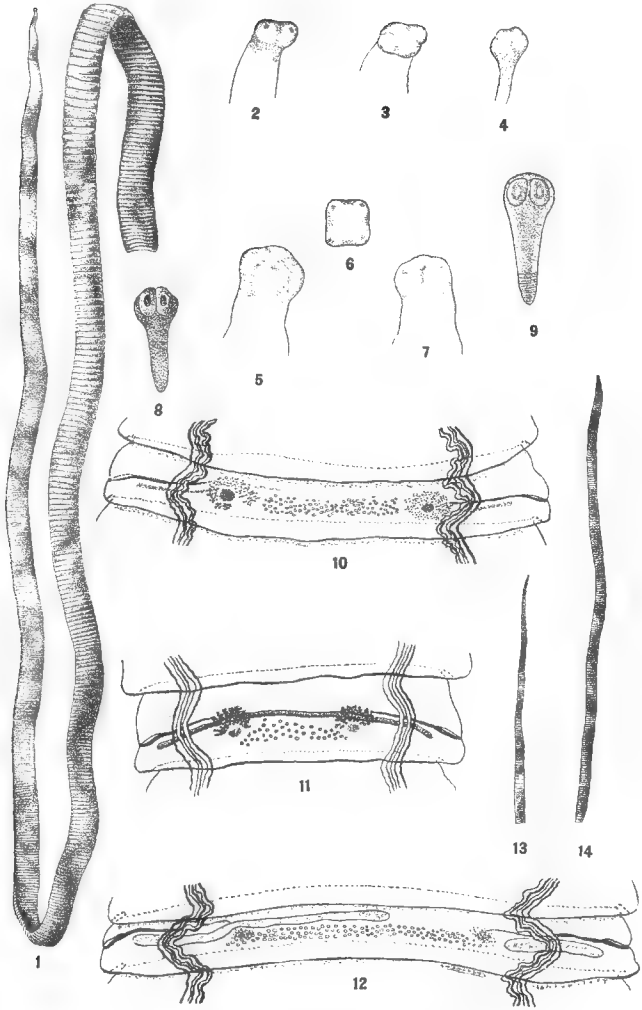


3

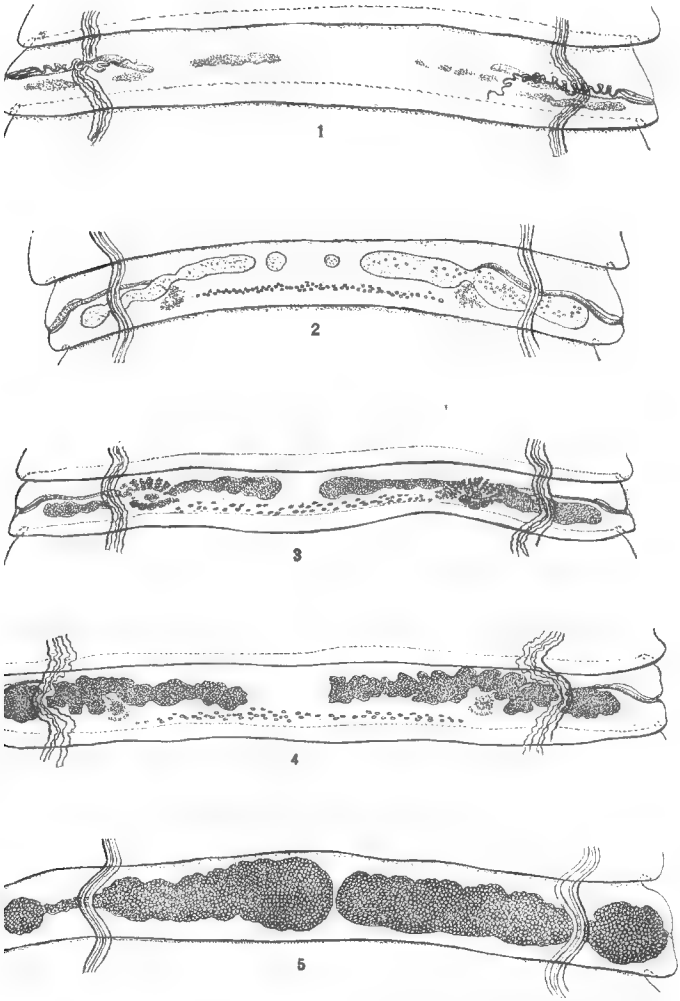
ANOPLOCEPHALINE TAPEWORM FROM THE COTTONTAIL RABBIT.

FOR EXPLANATION OF PLATE SEE PAGE 231.



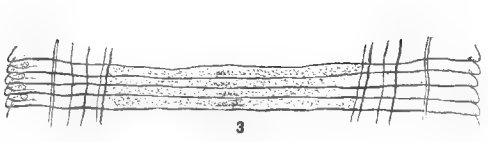
ANOPLOCEPHALINE TAPEWORMS FROM THE COTTONTAIL RABBIT.

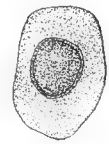
FOR EXPLANATION OF PLATE SEE PAGE 231.

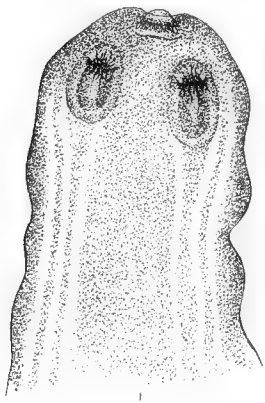


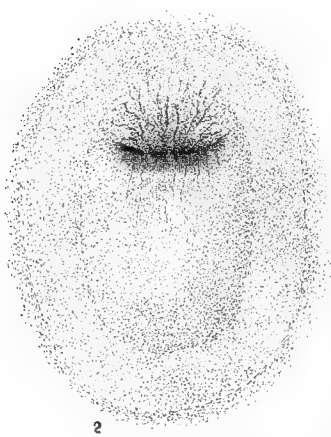
ANOPLOCEPHALINE TAPEWORM FROM THE COTTONTAIL RABBIT.

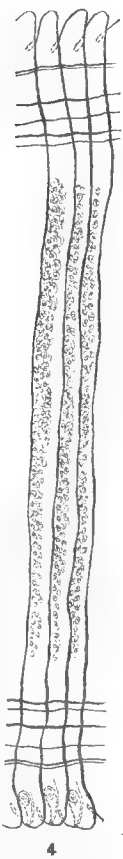
FOR EXPLANATION OF PLATE SEE PAGE 231.

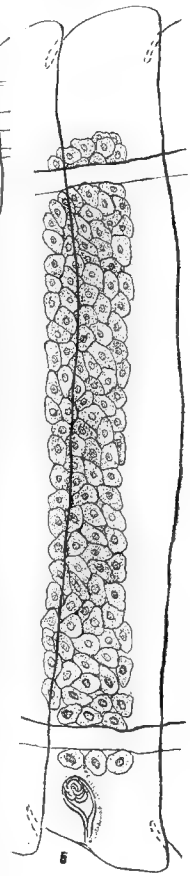






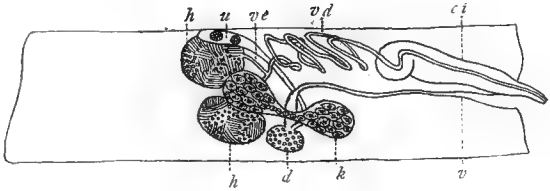






ARMED TAPEWORM FROM THE ARIZONA COTTONTAIL RABBIT.

FOR EXPLANATION OF PLATE SEE PAGE 231.



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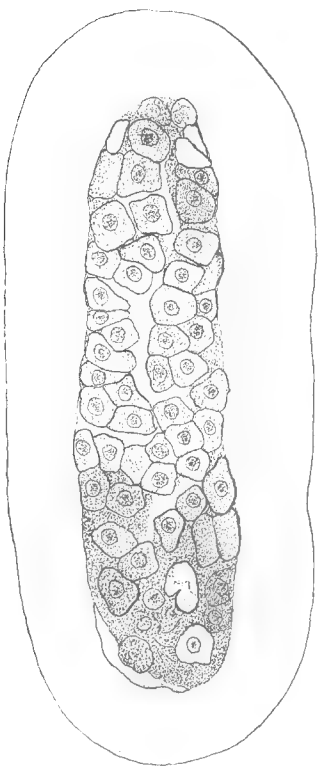

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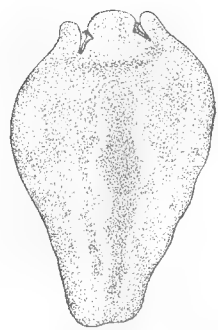

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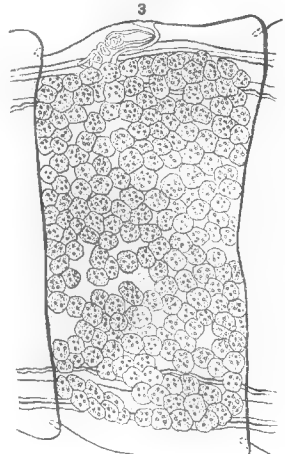
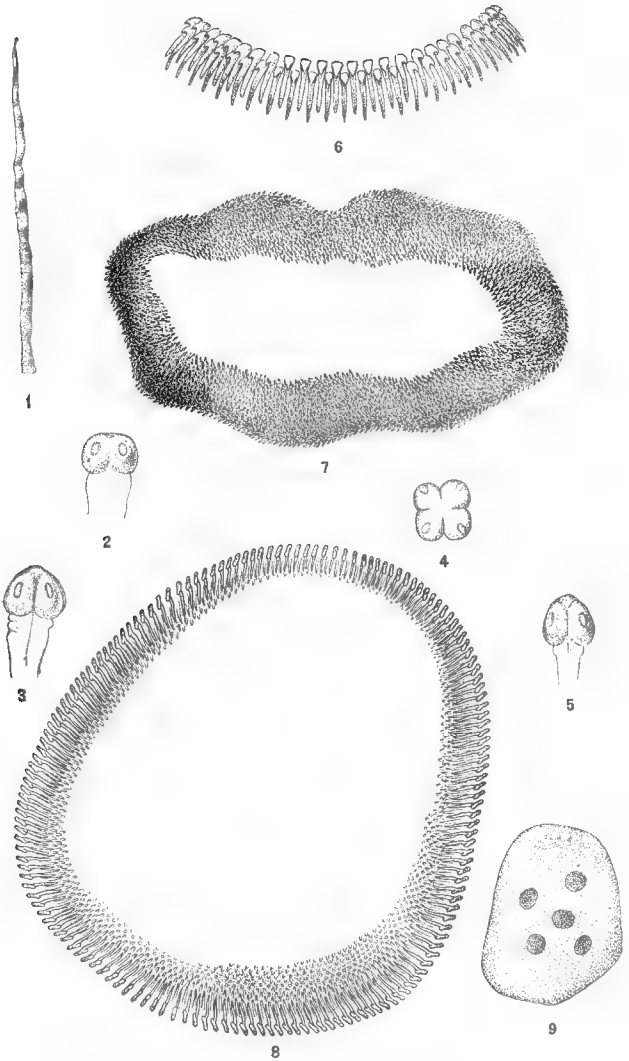


4

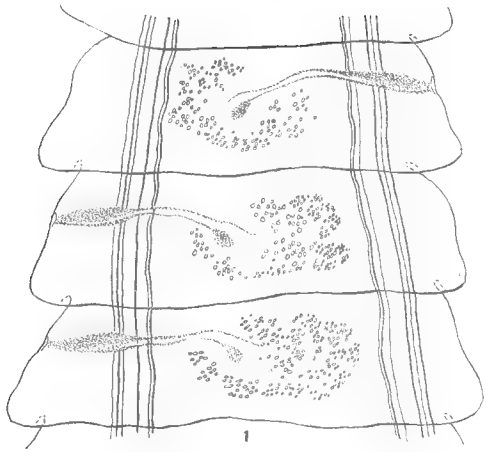
ARMED TAPEWORMS FROM THE ARIZONA COTTONTAIL RABBIT, THE COMMON INDIAN PANGOLIN, AND THE COTTONTAIL RABBIT.

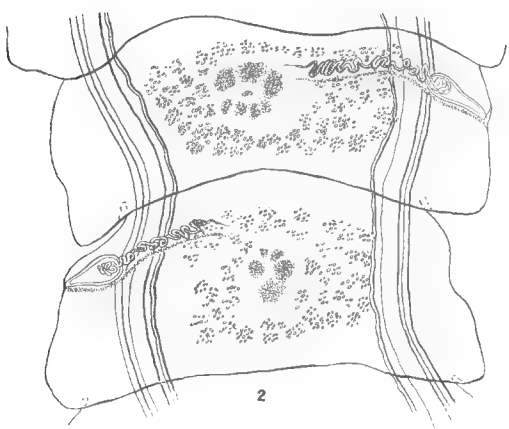
FOR EXPLANATION OF PLATE SEE PAGE 231.



ARMED TAPEWORM FROM THE COTTONTAIL RABBIT AND THE EASTERN JACKASS HARE.

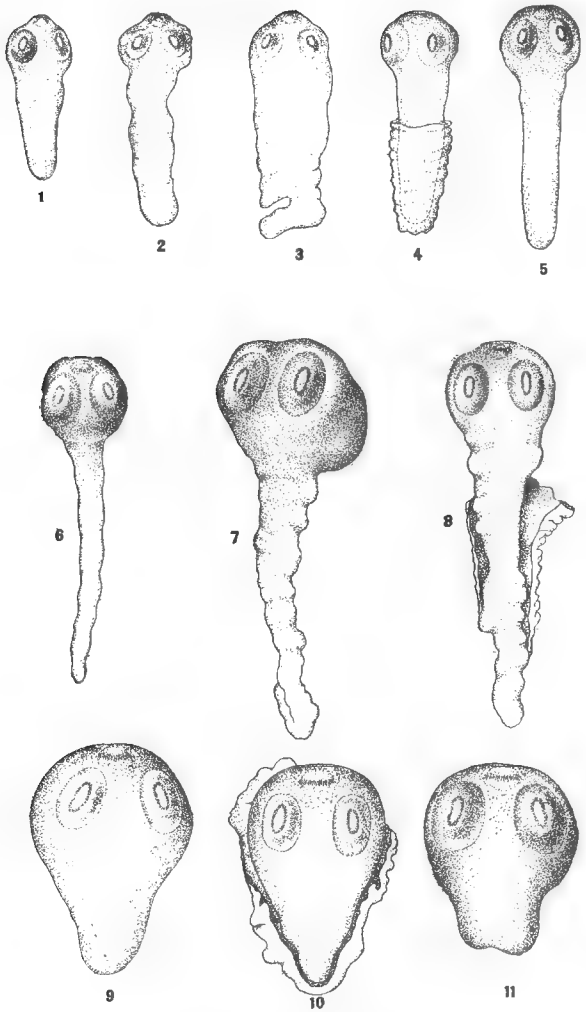
FOR EXPLANATION OF PLATE SEE PAGE 232.





ARMED TAPEWORM FROM THE EASTERN JACKASS HARE.

FOR EXPLANATION OF PLATE SEE PAGE 232.



YOUNG STAGES OF AN ARMED TAPEWORM FROM THE COTTONTAIL RABBIT.

FOR EXPLANASION OF PLATE SEE PAGE 232.

CONTRIBUTIONS TO THE NATURAL HISTORY OF THE COMMANDER ISLANDS.

XII.—FISHES COLLECTED AT BERING AND COPPER ISLANDS BY NIKOLAI A. GREBNITSKI AND LEONHARD STEJNEGER.

By TARLETON H. BEAN, M. D., M. S.,
Honorary Curator of the Department of Fishes,
and
BARTON A. BEAN,
Assistant Curator of the Department of Fishes.

THE COLLECTIONS here catalogued were obtained partly by Dr. Stejneger during his stay on the Commander Islands in 1882–83, and partly by Mr. Grebnitski from 1883 to 1885. The number of species is 45. Most of them were picked up on the beaches between tides; fishes from deeper waters were occasionally taken from stomachs of cod and wolf fish. No appliances for dredging or trawling were available, hence the fish fauna was by no means exhausted.

Notwithstanding the unfavorable conditions for making a collection, there are several very interesting species, as, for example, *Aspidophoroides monopterygius*, *Gasterosteus brachypoda*, *Gymnelis viridis*, and *Liparis tunicata*, forms belonging to western Atlantic and Greenland waters; the little known *Cottus axillaris* and *Cyclopterichthys rentricosus* are also represented. Doubtless, as Dr. Stejneger remarks, "a systematic search would add many species," but meanwhile the forms here mentioned will have an important bearing upon the zoological relations of the Commander Islands to the mainland of Asia and Alaska.

A series of specimens of *Anoplarchus* from Puget Sound, Washington, is introduced to show the variability of the squamation in one of its species.

SQUALUS ACANTHIAS, Linnæus.

A specimen was preserved in salt by Dr. Stejneger.

SALVELINUS MALMA (Walbaum), Jordan and Gilbert.

No. 33832, U.S.N.M. (1560). Bering Island, September 9, 1882; L. Stejneger. "*Goletz*" of the natives, according to the collector's notes.

No. 33836, U.S.N.M. (1561). Bering Island, September 9, 1882; L. Stejneger.

No. 33851, U.S.N.M. (2340). Copper Island, village creek, spring, 1883; L. Stejneger. "*Goletz*" of the natives. Young, 5 inches long.

No. 33820, U.S.N.M. (2510). Bering Island, 1883; L. Stejneger.

No. 38999, U.S.N.M. Bering Island, December, 1884; N. Grebnitski. Four examples.

ONCORHYNCHUS GORBUSCHA (Walbaum), Gill and Jordan.

No. 33862, U.S.N.M. (1417*a*). Young. Bering Island, August 11, 1882; L. Stejneger.

No. 33865, U.S.N.M. (2417). Young; L. Stejneger.

Concerning the first, Dr. Stejneger gives the following: "Silvery; green with small black spots on the back. Was given by the natives as undoubted *Baidarsik*. The Aleutian name was said to be *Tukukh*, or, in order to distinguish it from No. 1485, *Tchihanakh Tukukh*, that is, river *Tukukh*."

No. 1485 of Dr. Stejneger is the *Alagon Tukukh* of the Aleuts, *Morskoi Okun* of the Russians.

ONCORHYNCHUS KISUTCH (Walbaum), Jordan and Gilbert.

No. 33818, U.S.N.M. (2511). Male. Bering Island, spring, 1883; L. Stejneger. Anal rays developed, 14; branchiostegals, 13; gill rakers, 21+; pyloric cœca few; lateral line, 130.

No. 33830, U.S.N.M. (1554). Male, juvenile. Bering Island, September 9, 1882; L. Stejneger. Anal, 14; branchiostegals, 13; gill rakers, 20+; cœca few; lateral line, 133.

No. 33831, U.S.N.M. (1555). Male, juvenile. Bering Island, September 9, 1882; L. Stejneger.

No. 33827, U.S.N.M. (2512). Male, adult. Bering Island, May 10, 1882; L. Stejneger.

No. 33838, U.S.N.M. Female, juvenile. Bering Island, September 9, 1882; L. Stejneger.

No. 39001, U.S.N.M. Juvenile. N. Grebnitski. Two specimens.

ONCORHYNCHUS NERKA (Walbaum), Gill and Jordan.

No. 39000, U.S.N.M. Bering Island, December, 1884, N. Grebnitski. Five young individuals. B. 13; A. 15; scales, 133; gill rakers, 14+19; cœca few.

MALLOTUS VILLOSUS (Müller), Cuvier.

No. 33876, U.S.N.M. (2188). Bering Island, June 19, 1883; L. Stejneger.

No. 47560, U.S.N.M. Bering Island; L. Stejneger. Three specimens, two males and one female. The female 6½ inches and the males 6 inches long.

HEXAGRAMMUS ORDINATUS, Cope.

No. 38989, U.S.N.M. Bering Island, March, 1884; N. Grebnitski. Young. D. XIX, 25; A. 25; scales 90.

No. 38992, U.S.N.M. Bering Island, September, 1884; N. Grebnitski. D. XX, 24; A. 25; scales 93.

HEXAGRAMMUS ASPER, Steller.

No. 33847, U.S.N.M. (2533). Bering Island, September 1, 1882; L. Stejneger. D. XIX, 24; A. 25. L. lat. 93 (87 pores). A young specimen, 54 mm. long.

This specimen shows a most remarkable abnormality in the development of the lateral lines. The upper line on each side extends to the middle of the soft dorsal; the second line on the left side does not quite reach to below the end of the soft dorsal, while on the right side the corresponding line extends to the caudal; on the left side the line appears to start from a point nearly above the end of the ventral and extends upward and backward to about opposite the ninth ray of the anal; there is no corresponding line on the right side. The two lines running along the base of the anal, and extending to the caudal, converge in the usual way just behind the ventrals, and are continued forward in a single line to the root of the ventrals.

Gill membranes united very narrowly to the isthmus.

HEXAGRAMMUS SUPERCILIOSUS (Pallas), Jordan and Gilbert.

No. 33868, U.S.N.M. (1950). Bering Island, March 13, 1883, L. Stejneger. Length of specimen, 120 mm.; D. XXII, 22; A. 23.

The upper lateral line extends to below the end of the second dorsal; the second line to the upper edge of the caudal; the third to the middle of the caudal base; the fourth starts from the throat, passes close to the root of the ventral, and is continued backward to a little beyond the middle of the anal. The two lines running along the anal base to the tail converge about at the middle of the length of the ventrals, and are continued forward on the ridge of the abdomen almost to the isthmus. There is no trace of the branch characteristic of *H. ordinatus*, which begins a little in advance of the ventral origin and extends upward and backward to a point below the middle of the pectoral and sometimes farther back.

No. 38988, U.S.N.M.; Bering Island, March, 1884; N. Grebnitski. Young. D. XX, 23; A. 22; scales, 104.

PLEUROGRAMMUS MONOPTERYGIUS (Pallas), Gill.

No. 33821, U.S.N.M. (1669). Saranskaya Bay, Bering Island, September 30, 1882; L. Stejneger.

There is a color drawing by the collector whose notes upon the species are as follows: "Called by the natives *Sudak*, the Russian name

of *Lucioperca sandra* (Linnæus); is rather common at Copper Island, where it is extensively used for food. At Bering Island it is said to be rather scarce."

No. 38990, U.S.N.M. Bering Island, February, 1885; N. Grebnitski.

SEBASTICHTHYS, species.

No. 33900, U.S.N.M. (1748). Bering Island, November 26, 1882; L. Stejneger. From the gullet of *Larus canus*. One specimen, same as No. 33864, U.S.N.M., 41 mm. long to base of caudal.

No. 33864, U.S.N.M. (2347). Copper Island, on the beach, spring of 1883; L. Stejneger. Length of specimen, 62 mm.

D. XIII, 15; A. III, 7. Tubes in lateral line 51. The lower jaw projects and the spines of the head are well developed; they comprise nasal, three pairs along the upper edge of the orbit, another pair on the nape and a pair of long spines on the occiput.

COTTUS QUADRICORNIS, Linnæus.

No. 33875, U.S.N.M. (2487). Bering Island, 1883; L. Stejneger. Young. D. VIII, 14; A. 12.

COTTUS, species.

No. 47571, U.S.N.M. Bering Island, July, 1895; L. Stejneger. D. X, —. Length, 19 mm.; too small for identification.

COTTUS POLYACANTHOCEPHALUS, Pallas.

No. 33845, U.S.N.M. (1815). Bering Island, December 23, 1882; L. Stejneger. D. X, 14; A. 11.

"Color, dark olive gray with irregular lighter mottlings. Belly and sides with large oblong whitish spots. Pectorals dusky, with one perfect and two imperfect yellowish bands. Abdominals whitish, with two broad and distinct blackish cross bands and a fainter and narrower one at the base."—(Stejneger.)

No. 47572, U.S.N.M. Very young, two specimens. Beach, Copper Island, August 6, 1895; L. Stejneger. D. X, 15; A. 13. The larger is only $1\frac{5}{16}$ inches long. These may be *C. niger* Bean.

COTTUS PLATYCEPHALUS, Pallas.

= ? *C. Decastrensis*, Kner.

No. 38983, U.S.N.M. Bering Island, March, 1884; N. Grebnitski.

COTTUS NIGER, Bean.

No. 33899, U.S.N.M. (1464). Bering Island, August 14, 1882; L. Stejneger. "Found on the beach. Iris silvery alternating with violet red."—(Stejneger).

No. 33872, U.S.N.M. (1630). Young. Bering Island, September 12, 1882; L. Stejneger.

No. 33833, U.S.N.M. (1663). Young. Bering Island, September 23, 1882; L. Stejneger.

No. 33887, U.S.N.M. (2260). Young. Copper Island, July 14, 1883; L. Stejneger.

No. 33850, U.S.N.M. (2335). Young. Copper Island, spring, 1883; L. Stejneger.

No. 33881, U.S.N.M. (2336). Young. Copper Island, spring, 1883; L. Stejneger.

No. 33863, U.S.N.M. (2337). Copper Island, spring, 1883; L. Stejneger. D. VIII, 17; A. 12. Doubtful identification.

No. 33908, U.S.N.M. (2775). Copper Island, spring, 1883; L. Stejneger. D. IX, 15; A. 12. Doubtful identification.

No. 38979, U.S.N.M. Bering Island (?); N. Grebnitski. D. VII–IX, 15–17; A. 12–13; V. I, 3. Doubtful identification.

No. 38980, U.S.N.M. Bering Island, March, 1885; N. Grebnitski. D. IX, 16; A. 11. Length, 5⅝ inches.

No. 38981, U.S.N.M. Bering Island, March, 1884; N. Grebnitski.

COTTUS AXILLARIS (Gill), Bean.

No. 39428, U.S.N.M. Bering Island; N. Grebnitski.

Total length, 4 inches; length to caudal base, 3¼ inches. Head, 1⅛ inches; eye, 4½ in head.

The maxilla reaches to below the hind margin of pupil; the ventral to the base of the second anal ray; the pectoral to the base of the seventh anal ray.

The snout is very narrow, acute, shorter than the eye. The interorbital space very narrow, less than one-half length of eye. Postorbital ridges inconspicuous.

Several milk-white blotches at base of pectoral. A band of the same color on the first half of pectoral; two similar blotches behind pectoral and about seven on the side of the body.

B. VI; D. IX, 14; V. I, 3; A. 12; pores 34+2.

ENOPHRYS DICERAUS, Pallas.

No. 39429, U.S.N.M. Bering Island; N. Grebnitski. Length, 1½ inches.

BLEPSIAS CIRRHOSUS (Pallas). Günther.

No. 47563, U.S.N.M. Bering Island; L. Stejneger. Length, 2⅝ inches. D. IV, III, 23; A. 18; lateral line, 56.

HEMILEPIDOTUS JORDANI, Bean.

No. 33843, U.S.N.M. (1705). Bering Island, November 1, 1882; L. Stejneger. D. XI, 22; A. 18. There is a color drawing of this example by Dr. Stejneger.

No. 38986, U.S.N.M. Bering Island, March, 1883; N. Grebnistki. D. XI, 21; A. 17.

No. 38987, U.S.N.M. Bering Island, December, 1884; N. Grebnitski. Two individuals taken near shore. Mr. Grebnitski gives the native name of *Kalaga*. D. XI, 21; A. 16–18.

ARTEDIUS LATERALIS, Girard.

No. 38985, U.S.N.M. Bering Island, January, 1885; N. Grebnitski. "From stomach of *Gadus morrhua*." D. IX, 18; A. 13.

GYMNACANTHUS PISTILLIGER (Pallas), Gill.

No. 33889, U.S.N.M. (1948). Bering Island, May 12, 1883; L. Stejneger.

A young example, 50 mm. long, from the stomach of a cod (*Gadus morrhua*). D. XI, 15; A. 18. On account of the size and condition of the specimen its identification is doubtful; indeed, the armor of the head and its length resemble those characters in *galeatus* rather than *pistilliger*.

CYCLOPTERICHTHYS VENTRICOSUS (Steindachner), Jordan and Gilbert.

No. 33837, U.S.N.M. (2012). Bering Island, May 7, 1883; L. Stejneger.

"This is the *Miakaia Riba* or *Miakinka*, i. e., soft fish. The first one of this spring (1883) was taken on March 21, and they were afterwards found in great numbers on the beach up to the middle of May, when they again disappeared.

"In the beginning the natives eat them with great gusto, but soon get tired of them, and they are then used only for food for the sledge dogs. Mr. Volokitin informed me that the same species occurs, but much more scarce, at Atka, on which island he was born."—(Stejneger.)

Dr. Stejneger made a color drawing of this species, one-fourth natural size.

No. 33806, U.S.N.M. (2513). Bering Island, spring of 1883; L. Stejneger. D. 10; A. 7; P. 19. "'*Miakinka*' of the natives."—(Stejneger.)

EUMICROTREMUS SPINOSUS (Müller), Gill.

No. 38976, U.S.N.M. Bering Island; N. Grebnitski. "From stomach of *Alepidosaurus æsculapius*."

Alepidosaurus æsculapius is not in the collections forwarded by Messrs. Grebnitski and Stejneger, but, as it is quite well known at Unalaska, there is little doubt that it occurs in the deep waters around the Commander Islands.

LIPARIS CALLIODON (Pallas), Günther.

No. 33822, U.S.N.M. (1124). Bering Island, May 30, 1882; L. Stejneger. Found on the beach. A female with eggs somewhat developed. Length, 77 mm. to caudal base.

No. 33823, U.S.N.M. (1662). Bering Island, September 23, 1882; L. Stejneger. Length to caudal base, 67 mm. Head, 17 mm. Eye, $2\frac{1}{2}$ mm. Greatest height, 15 mm.

The maxilla reaches nearly to the vertical through the middle of the eye. Interorbital space, 7 mm.; snout, 5 mm. Distance of dorsal from snout, 24 mm.; anal from snout, 31 mm. Ventral disk, 7 mm. Middle caudal rays, 12 mm. Length of pectoral, 9 mm. Vent from snout, 22 mm. Width of head, 14 mm.

D. about 33; A. 24 or 25. Colors: "Above yellowish olive, whitish below." "Picked up on the beach at low water."—(Stejneger.)

No. 33846, U.S.N.M. Two specimens from Bering Island, the larger one measuring 88 mm. to the caudal base and the smaller one 71 mm. Both are females, the larger one with eggs well developed and the smaller with mature ova. D. 31; A. 27.

No. 33856, U.S.N.M. (2338). Copper Island, spring, 1883; L. Stejneger. The ventral disk is about one-half as long as the head. The eye one-half length of snout, less than one-sixth length of head. D. about 32; A. 24.

The larger specimen, 69 mm. long to base of caudal, is a female with eggs moderately developed. The smaller is 59 mm. long to caudal base.

No. 33884, U.S.N.M. (2339). Copper Island, spring, 1883; L. Stejneger. Two young examples, 33 mm. in length each. These have the first dorsal elevated, and are probably males.

No. 38972, U.S.N.M. Bering Island, March, 1884; N. Grebnitski.

Eight specimens. Two of them have D. VII, 26 and V, 30; A. 25; the rest have the anal rays 28 to 30. This series, together with Dr. Stejneger's examples, will prove that *L. cyclopus* of Günther is identical with *L. calliodon*.

No. 38973, U.S.N.M. Bering Island, March, 1883; N. Grebnitski.

Two specimens. Anal rays 26 in one, 27 in the other.

No. 47561, U.S.N.M. Bering Island; L. Stejneger. Eight individuals, the largest $5\frac{3}{8}$ inches long, the smallest $2\frac{3}{8}$ inches. The largest has D. V, 31; A. 29.

LIPARIS TUNICATA, Reinhardt (?).

? *Liparis fabricii*, GÜNTHER, Cat., III, 161.

No. 38975, U.S.N.M. Bering Island, November, 1883; N. Grebnitski.

D. 7, 33; A. 32; P. 37; C. 13; length, 9 inches. Color, uniform purplish brown, except the disk, which is pale. First seven dorsal rays differentiated from the rest of the fin and somewhat elevated.

Snout broad and blunt, projecting beyond the lower jaw; its length one-third the length of the head, and less than the width of the interorbital space, which is three-sevenths of the length of the head. Anterior nostrils tubular, posterior not tubular. The length of the anterior nostril is about two-thirds that of the eye. Nape moderately

elevated. Eye very small, its length equal to one-fifth the width of interorbital space, and less than one-third the length of the snout.

The angle of the mouth is about under the middle of the eye; the width of the mouth at the angle equals the length of the head without the snout. The greatest width of the head is equal to its length, which is three-elevenths of the total to caudal base. Teeth in many rows in the jaws, sometimes blunt, but nearly all sharp pointed; no apparent tricuspid teeth.

The disk is placed very little behind the vertical through the hind margin of the eye. Its width and length are nearly equal, the latter equal to width of interorbital space and contained $8\frac{1}{3}$ times in the total length to caudal base.

The distance of the dorsal from the snout is one-third of the total length to caudal base. The longest dorsal ray is one-half as long as the head.

The distance of the vent from the disk is a little more than one-fourth the length of the head, the vent being almost under the origin of the dorsal. The anal origin is under the eleventh dorsal ray.

The pectoral reaches beyond the vent; its length equals that of the postocular part of head.

The caudal is one-half as long as head, and is not continuous with the dorsal and anal.

This does not agree with the descriptions of *L. tunicata* and *L. fabricii* in color and in the continuity of the vertical fins, but in other respects the agreement appears to be perfect. *L. arctica*, Gill, which this species resembles in color, has the vertical fins confluent, the interorbital space one-third length of head, the caudual one seventh of total length, and the anterior nostrils simple and posterior tubular.

HYPSAGONUS QUADRICORNIS (Cuvier and Valenciennes), Gill.

No. 38984, U.S.N.M. Bering Island, January, 1885; N. Grebnitski. D. X, 6; A. 10; V. 3. "From stomach of *Gadus morrhua*."

PODOTHECUS ACIPENSERINUS (Tilesius), Gill.

No. 47570, U.S.N.M. Bering Island; N. Grebnitski. Length, $4\frac{7}{8}$ inches. D. IX, 6; A. 7; L. lat., 37.

Head $3\frac{3}{8}$ in length to caudal base. Depth equals one-half head. Eye, one-half snout, $4\frac{1}{2}$ in head. A pair of spines at tip of snout, a pair on snout near tip, a pair close together on top of snout near the eyes. Supraocular produced behind into a short flat spine on each side. Tufts of cirri under the snout and near angle of mouth.

ASPIDOPHOROIDES MONOPTERYGIUS (Bloch), Storer.

No. 33849, U.S.N.M. (2769). Copper Island 1882; L. Stejneger. One specimen, 52 mm. long. D. V; A. 5; L. lat., 49.

BATHYMASTER SIGNATUS, Cope.

No. 33895, U.S.N.M. (1228). Copper Island, June 28, 1883; L. Stejneger. Three specimens.

These are the youngest examples of the species in the Museum; the length is only 47 mm., and the sides are banded, the number of bands being 9 or 10, about two-thirds as wide as the eye is long and extending upon the dorsal fin. The dark blotch at the beginning of the dorsal is very distinct, as is also the line of minute black dots under the dorsal base. D. 46; A. 32; scales, 97.

No. 34869, U.S.N.M. (No. 2333). Bering Island, Stare Gavan; L. Stejneger. Length of example, 180 mm.; D. 44; A. 33; lateral line, 94, not quite reaching base of caudal and ending much nearer dorsal outline than middle of depth. Head scaleless, but profusely covered with mucous pores. Gill rakers very short, 13 below angle of first arch.

No. 47559, U.S.N.M. Bering Island; L. Stejneger. One example, 7¼ inches long. D. 45; A. 31; lateral line, 98.

No. 38968, U.S.N.M. Bering Island, 1885; N. Grebnitski. One young "from stomach of *Gadus morrhua*."

No. 38969, U.S.N.M. Bering Island, November, 1883; N. Grebnitski.

No. 38970, U.S.N.M. Bering Island, August, 1884; N. Grebnitski.

No. 33890, U.S.N.M. (1947). Bering Island; L. Stejneger, March 12, 1882. From stomach of *Gadus morrhua*.

Length, 4⅛ inches; head, ⅞; depth, $\frac{9}{16}$; snout shorter than eye, which is nearly 4 in head. Maxilla extends to below hind margin of eye. Lateral line pores about 90.

The condition of the specimen is such that the dorsal can not be counted with any certainty, but there are not fewer than 41 rays and spines. A. 33.

Body light brown without traces of black cross bands. Mucous pores on postorbital region and opercles with narrow black margin giving the appearance of black specks; fins dark. More elongate than the ordinary *signatus*, being somewhat similar in form and coloration to *B. hypoplectus* of Gilbert, but differing from the latter in having a greater cleft of mouth, scaleless cheeks, and gill membranes not broadly united.

TRICHODON TRICHODON (Tilesius).

No. 33841, U.S.N.M. (1955). Bering Island, March 14, 1883; L. Stejneger. "Found dead ashore. Silver colored with black spots."—(Stejneger.)

No. 33828, U.S.N.M. (1968). Bering Island, April 10, 1883; L. Stejneger. Four examples, from 5 inches to 6½ inches long.

"Iris silver colored with faint pinkish reflex. Color silver white with a faint gloss of brass above. Spots blackish. Aleut name, *Anamlukh*. Rather common at that time."—(Stejneger.)

No. 33878, U.S.N.M. (2316). Copper Island; L. Stejneger.

No. 38971, U.S.N.M. Bering Island, March, 1884; N. Grebnitski. Three individuals.

ANOPLARCHUS ALECTROLOPHUS (Pallas), Jordan and Gilbert.

No. 33904, U.S.N.M. (1029). Bering Island, May 10, 1882; L. Stejneger. Two specimens. Length, 90 to 97 mm. D. LXI; A. 43.

The following color notes were made by the collector: Color, olive brown, with darker and lighter spots. On the lower jaw, several transverse light, dark-bordered stripes. Both of these have the crest on the head well developed.

No. 33819, U.S.N.M. (1126). Bering Island, May 30, 1882; L. Stejneger. On the beach. Forty-nine specimens. Length, 40 to 122 mm.

No. 33894, U.S.N.M. (1463). Bering Island, August 14, 1882; L. Stejneger. "Beach. Color purplish black, with cream-colored figures." Length, 28 mm. D. LIX; A. 42.

No. 33893, U.S.N.M. (1921). Bering Island, February 20, 1883; L. Stejneger. Found on beach.

Colors observed by the collector: Color purplish blackish brown, with bluish white spots on anal and sides of lower jaw. Length, 93 mm. Crest well developed.

No. 33905, U.S.N.M. (1946). Bering Island, March 11, 1883; L. Stejneger. "Color purplish blackish brown." Length, 70 mm.

No. 33891, U.S.N.M. (1949). Bering Island, March 13, 1883; L. Stejneger. A color drawing of this example by Dr. Stejneger. Length, 92 mm. D. LXII; A. 45.

No. 33871, U.S.N.M. (2345). Copper Island, spring of 1883; L. Stejneger. Length, 78 mm. D. LXII; A. 43. Crest well developed.

No. 33892, U.S.N.M. (2353). Bering Island, spring, 1883; L. Stejneger. Three young, 36 to 50 mm. long. D. LXIII; A. 45 in the largest.

No. 33880, U.S.N.M. (2488). Bering Island; L. Stejneger. Three specimens, length, 75 to 85 mm. One of these has D. LX; A. 45, and the scales absent on anterior half of body in front of seventh anal ray; it has also a low crest. The same absence of scales is found in 38960 and 38962 of Grebnitski's collection, and in various examples of Dr. Stejneger's.

No. 38961, U.S.N.M. Bering Island, November, 1883; N. Grebnitski. One specimen 90 mm., with a high crest. D. LXI; A. 44.

No. 38962, U.S.N.M. Bering Island, March, 1884; N. Grebnitski. Twenty-six specimens, showing a great deal of variation in the development of the crest. The smallest is 61 mm. long, largest 113. D. LXII; A. 45. In the largest example, D. LXIII; A. 44.

The variability in the squamation is still further shown in the following individuals from the State of Washington.

D. LVI; A. 39. The length of this specimen is 115 mm. It has a

distinct black blotch at the beginning of the dorsal fin, on the membrane between the first and second and second and third spines. All of the eleven specimens of this catalogue number (34321, Port Townsend, Washington) have the same characteristic blotch at the origin of the dorsal, but it is usually single and about as long as the eye.

In all of these specimens the anterior portion of the body from the head to sixth anal ray is naked. In one of the examples, 113 mm. long, the dorsal has 55 spines and the anal 39 rays.

In a specimen, No. 42053, from Seattle, Washington, 132 mm. long, the anterior portion of the body is naked, as in the other specimens. The black blotch is present on the dorsal, and the same is true in all of the twelve examples of this entry. The dorsal in a very large specimen (140 mm. long) has only 57 spines, and the anal 39 rays. Still another example has D. LVI; A. 39.

PHOLIS ORNATUS (Girard), Gill.

No. 33826, U.S.N.M. (1028). Bering Island, May 10, 1882; L. Stejneger. Dr. Stejneger describes the color as bronze olive. There are two specimens, the larger one 90 mm. and the smaller 56 mm. long to the base of the caudal fin.

No. 33861, U.S.N.M. (1125). Bering Island, May 30, 1882; L. Stejneger. Total length of specimen, 115 mm.; length of caudal, 7 mm. The dorsal contains about 75 spines.

No. 38965, U.S.N.M. Bering Island, March, 1884; N. Grebnitski. Eleven specimens, varying in color from light olive brown to bright pink. All have the ocellated spots along the spinous dorsal well developed. They vary in length from 77 to 130 mm.

No. 33873, U.S.N.M. (2342). Copper Island, April, 1883; L. Stejneger. On the beach. Length to base of caudal, 117 mm. D. LXXX; A. II, 37; head scaleless.

No. 33886, U.S.N.M. (2344). Copper Island, spring, 1883; L. Stejneger. Found on the beach. Length of specimen, 53 mm. D. LXXIX; A. II, 37.

PHOLIS RUBERRIMUS (Cuvier and Valenciennes).

No. 33834, U.S.N.M. (1050). Bering Island, May 15, 1882; L. Stejneger. Length of specimen, 205 mm. D. XCV; A. II, 44.

Eye equal to snout, 5 in head. Mouth very oblique, the maxilla scarcely reaching to below the front of the eye, its length $3\frac{1}{2}$ in head; mandible $2\frac{1}{2}$ in head; middle caudal rays, 2 in head.

The head is contained in the total length, without caudal, 9 times; the greatest depth 8 times. The body is very much compressed; the vent is nearly midway between the end of the head and the origin of the middle caudal rays. The pectoral is well developed, containing 15 rays. Its length equals two-fifths that of the head. The scales are very thin, small, and inconspicuous. Ventrals, under the base of the

pectorals, each consisting of a short spine only two-thirds as long as the eye. The caudal is united with the dorsal and the anal, but is not tapering.

The following are Dr. Stejneger's field notes: "Color olive brown, with minute black spots; belly yellowish; a white line runs through the lower border of the nostrils, below the eyes backward to the posterior margin of the operculum in the direction of the pectoral fin."

No. 33855, U.S.N.M. (2341). Copper Island, spring of 1883; L. Stejneger. Length of specimen, 155 mm.

D. XCIV; A. II, 46 or 47. In this specimen the maxilla extends to a point below the front of the eye. The pectoral is two-fifths as long as the head, and the ventral but two-thirds as long as the eye. The caudal is connate with the dorsal and anal, but is distinctly differentiated from these and consists of a large number of rays (22).

No. 33877, U.S.N.M. (2341). Same as above. This example, which is 117 mm. long, has 92 dorsal spines. Its pink color is still preserved, and there are traces of numerous narrow, nearly vertical, pale bars across the posterior portion of the dorsal fin.

No. 38963, U.S.N.M. Bering Island, March, 1884; N. Grebnitski. Six specimens. The bright pink color of these examples is well preserved. In one of them the dorsal has 94 spines; anal II, 46.

The coloration of the species is very brilliant. Across the spinous dorsal there are 20 narrow, nearly vertical, pale streaks. Similar streaks to the number of 12 cross the anal. Along the middle line of the body there are 18 small, narrow, round, pale spots at irregular intervals about as large as the pupil. Some of the specimens still show the white line running obliquely from the tip of the snout under the eye to the end of the head, limited above in some specimens by a narrow line slightly darker than the body color. The pectoral is pale at base and tip, the middle portion pink. Sometimes the pink area is closer to the base, leaving most of the fin pale.

The length of these examples varies from 130 to 150 mm. In only one of these the caudal fin is sharply differentiated from the dorsal and anal by the oblique direction of its rays.

GYMNELIS VIRIDIS (Fabricius), Reinhardt.

No. 33897, U.S.N.M. (1005). Copper Island, beach, May 6, 1882; L. Stejneger.

No. 33901, U.S.N.M. (1513). Copper Island, May 6, 1882; L. Stejneger.

No. 33885, U.S.N.M. (2343). Copper Island, beach, spring, 1883; L. Stejneger.

No. 33870, U.S.N.M. (2345). Copper Island, beach, spring, 1883; L. Stejneger.

ANARRHICHAS LEPTURUS, Bean.

No. 33902, U.S.N.M. (1001). Bering Sea, May 1, 1882; L. Stejneger. A single very young individual was found on the deck of the vessel after a gale.

The length is slightly more than 19 mm. The dorsal is long and begins near the head. The anal is long and the vent is not far behind the head. Eye very large. Pectorals large. A separate caudal. I am unable to find ventrals. Although the specimen is very small, it is pretty certain that it represents the species named.

AMMODYTES PERSONATUS, Girard.

No. 33898, U.S.N.M. (1706). Bering Island, November 3, 1882; L. Stejneger, "Cast ashore. Color silvery; back green, iridescent at the border of the silvery white of the lower surface; on top of head a golden yellowish spot." Three specimens; average length, 83 mm.

No. 33906, U.S.N.M. (1707). Same as above; six specimens, the largest 85 mm. long.

No. 33907, U.S.N.M. (1708). Seven specimens, the largest 90 mm., same locality as the two preceding and the same notes by the collector.

No. 33883, U.S.N.M. (2189). Bering Island, May, 1883; L. Stejneger. Branchiostegals 6. D. 61; A. 29. Lateral folds, 160; pores, 133. Length of specimen, 117 mm.

No. 47562, U.S.N.M. Bering Island; L. Stejneger. D. 59; A. 28. Length, $6\frac{3}{4}$ inches; head, $1\frac{3}{8}$ inches. Mandible reaches to below middle of eye. Depth, three-fourths of an inch, one-eighth of total without caudal. Head nearly $4\frac{1}{2}$ in total to caudal base. Lateral folds, 142.

GADUS MORRHUA, Linnæus.

No. 33825. U.S.N.M. (1681). Bering Island, October 10, 1882; L. Stejneger. A single young example of which Dr. Stejneger made a color drawing.

POLLACHIUS CHALCOGRAMMUS (Pallas), Jordan and Gilbert.

No. 33882, U.S.N.M. (1893). Bering Island, March 30, 1882; L. Stejneger. A single example $4\frac{1}{2}$ inches long.

ELEGINUS NAVAGA (Kolreuter).

No. 33840, U.S.N.M. (1902). Bering Island, February 10, 1883; L. Stejneger. This was found dead on the beach. Dr. Stejneger noted the following colors: "Above olive gray, below whitish, sides with a gloss of brass."

No. 33829, U.S.N.M. (1903). Bering Island, February 11, 1883; L. Stejneger.

No. 33835, U.S.N.M. (1904). Bering Island, February 11, 1883; L. Stejneger.

No. 38956, U.S.N.M. (1). Bering Island, March, 1884; N. Grebnitski. One example.

No. 38957, U.S.N.M. Bering Island, February, 1885; N. Grebnitski. One specimen from a fresh-water lagoon, 2 miles from the station.

PLEURONECTES STELLATUS, Pallas.

No. 33842, U.S.N.M. (1642). Bering Island, September, 1882, L. Stejneger.

GASTEROSTEUS CATAPHRACTUS (Pallas), Jordan and Gilbert.

No. 33867, U.S.N.M. (1027). Bering Island, May 10, 1882. L. Stejneger. Fifteen specimens.

No. 33860, U.S.N.M. (1050). Bering Island, May 15, 1882, L. Stejneger. Length of specimen, 71 mm.

D. II, I, 14; A. I, 9; P. 10. Lateral plates, 34. The ventrals extend to the end of the pubic bone. The upper and lower pectoral rays are slightly longer than the middle rays, so that the fin when naturally expanded shows a slightly concave posterior margin. The caudal keel is well developed. The ventral spines are strongly serrated on their upper edge and rough along the lower margin with some strong serrations at the base.

No. 38954, U.S.N.M. Bering Island, N. Grebnitski. Four specimens, ranging from 71 to 80 mm. in length.

GASTEROSTEUS MICROCEPHALUS, Girard.

No. 33853, U.S.N.M. (1272). Saranna Lake, Bering Island, July 17, 1882, L. Stejneger. Three specimens, the two larger 90 mm., the smallest 50 mm. long.

D. II, I, 11; A. I, 8. There are eight plates developed on each side; the first two small, the last reaching to or slightly beyond the end of the extended pectoral.

In general appearance this species resembles *cataphractus* with the posterior portion of the body naked.

No. 38955, U.S.N.M. Bering Island, N. Grebnitski. One specimen, 70 mm. long. This is a very short-bodied individual, its depth equaling two-sevenths of the length without caudal. It has only four large lateral plates developed and two or three rudiments.

Four additional examples were obtained here.

No. 38952, U.S.N.M. (1337). Bering Island, July 28, 1882, L. Stejneger. "From fresh-water pond behind the new cemetery."

Seven specimens, young, the largest being but 18 mm. long; one with three dorsal spines. The lateral plates on some of the examples are not developed, but there is little doubt that these belong to *microcephalus*.

No. 39430, U.S.N.M. Bering Island, N. Grebnitski. Two specimens, the larger 80 and the smaller 65 mm. long. The former has eight plates developed, the eighth being just behind the end of the extended pectoral; the anterior three are very small. The ventrals do not reach to the end of the pubic bone. D. II, I, 12; A. I, 9.

The smaller example has one more plate developed on the left side than on the right.

GASTEROSTEUS PUNGITIUS BRACHYPODA, Bean.

No. 33896, U.S.N.M. (1273). Bering Island, July 20, 1882, L. Stejneger. Four examples, the largest 28 mm. long. From small fresh-water pond in Gavanskaya Swamp. D. X, 10; A. I, 9.

No. 33824, U.S.N.M. (1337). Bering Island, July 28, 1882, Stejneger. From fresh-water pond behind the new cemetery. Female 60 mm. long, with eggs. Dorsal spines alternating, XI, 11; A. I, 9. The ventral spines do not extend to the posterior end of the pubic bone; their length equals two-fifths that of the head, being nearly equal to eye and snout combined.

No. 38953, U.S.N.M. Bering Island, January, 1885, N. Grebnitski. Six specimens. Some of these specimens show distinct dark bands along the sides, in one example 11 in number. In other specimens the bands are more or less obscure. There is a curious diversity in the arrangement of the dorsal spines, which in some cases are nearly in a straight line throughout the greater part of the length of dorsal base, while in others the alternation is so decided as to make the top of the back resemble a hedge. The specimens with distinct bands are apparently males. They vary in length from 38 to 62 mm. Five of the larger examples have the stomachs distended by intestinal worms. From a single specimen four of these large parasites resembling tape worms were taken, the worms being broad, flat, and about 25 mm. in length.

No. 39431, U.S.N.M. Same as above. Six specimens varying in length from 52 to 80 mm. In all of these the ventral spine is very short, shorter than the pubic bone; the largest example has the ventral spine one-third as long as the head. D. VIII–X, I, 9–10; A. I, 8–9.

No. 39432, U.S.N.M. As above. One specimen, 70 mm. long. In this example the dorsal has 12 spines and 10 rays, and the anal is I. 9; length, $2\frac{11}{16}$ inches.

IS THE FLORIDA BOX TORTOISE A DISTINCT SPECIES?

By EINAR LÖNNBERG.

IN MY "Notes on Reptiles and Batrachians collected in Florida in 1892 and 1893,"[1] I recorded *Terrapene carolina* (Linnæus) among the Testudinata of my collection. Recently this form was divided into several "species," and from Florida a "new species" was described under the name of *Terrapene bauri*, Taylor.[2] It is therefore natural that I should be curious to learn to which of the six North American "species" my Florida specimen belonged, and for that reason I re-examined a skeleton of a specimen caught not far from Apopka, Orange County, Florida. It seems that two of the most important characters are osteological, namely, first, presence and different development or absence of the zygomatic arch; second, number of phalanges of fingers and toes. Hence one ought to be able to classify a skeleton without difficulty. My specimen had the hind limb with only three clawed digits and would thus, according to Taylor, be *T. bauri*, or *T. mexicana*, or *T. triunguis*. The number of the phalanges on the fore foot are 2, 3, 3, 3, 2, and on the hind foot 2, 3, 3, 2, 1 (0?). This indicates *T. bauri*, but *T. bauri* should have a complete zygomatic arch, and my specimen has none. In fact, there is not the slightest rudiment left of any quadratojugal, so that in this respect my specimen agrees with *T. ornata*, a species with four clawed digits on the hind limb and quite different number of phalanges (fore foot, 2, 2, 2, 2, 2; hind foot, 2, 3, 3, 3, 1). The osteological characters of this Florida specimen are therefore not identical with those of any hitherto described "species." Still I do not wish to create a new one. The color of my specimen corresponds very closely to that of *T. bauri*.[3] The ground color of the carapace is dark brown with yellow keel, yellow radiating lines with a few spots of the same color. The plastron is yellow with mostly transverse, brown markings. The length of carapace is 165 mm.

It would appear that Taylor established the species *T. bauri* on only one specimen. Under such circumstances the following possibilities

[1] Proc. U. S. Nat. Mus., XVII, 1894, pp. 317-339.

[2] W. E. TAYLOR: The box tortoises of North America, Proc. U. S. Nat. Mus., XVII, 1894, pp. 573-588.

[3] *T. bauri* and *ornata* resemble each other in color.

can be considered: (1) *T. bauri*, Taylor, and my specimen belong to the same species, although one of the specimens is anomalous; or (2) they belong to different varieties; or (3) one of them is a hybrid form. The first supposition seems rather improbable, for if the one specimen has a zygomatic arch one must expect to find at least rudiments of a quadratojugal in the other. On the other hand, it would be strange if two different forms of this genus lived in the same region but were not known outside of that territory. Or are perhaps all the forms of *Terrapene* only local varieties? This opinion seems, however, now to be abandoned by most zoologists since Boulenger lately accepted as species five North American forms of this genus.[1] With the material now at command, the nature of the Florida form can not be decided, but I have thought it desirable to point out the differences in my Florida specimen and to call the attention of American zoologists to the box tortoise of Florida, and at the same time add a little to the knowledge of the variations of this genus.

[1] Ann. and Mag. Nat. Hist., 6 ser., XV, 1895, pp. 330–331, namely: *major*, Agassiz, *mexicana*, Gray, *cinosternoides*, Gray (= older name for this form than *triunguis*, Agassiz), *carolina* (Linnæus), and *ornata*, Agassiz, from Yucatan—*yucatana*.

SUMMARY OF THE HEMIPTERA OF JAPAN, PRESENTED TO THE UNITED STATES NATIONAL MUSEUM BY PROFESSOR MITZUKURI.

By PHILIP R. UHLER,
President of the Maryland Academy of Sciences.

THE FOLLOWING list, with the descriptions of species supposed to be new to science, includes the collection of Japanese Hemiptera, which was exhibited at the World's Columbian Exposition in Chicago, and subsequently presented to the United States National Museum by Doctor K. Mitzukuri, Professor at the Imperial University of Tokio, Japan. It embraces the greatest number of species of this order which have thus far been made accessible for scientific study. The museums of Europe are not rich in collections of these insects from Japan, and it is only within the last twenty-five years that much attention has been given to their acquisition. Thunberg was the first to describe any considerable number of the species, and a lapse of thirty-five years took place before Motschulsky next took up the subject and described a few additional species. The later authors who have recently made known the largest proportion of the species are Messrs. Scott, Distant, and Horvath, but they seem to have been unacquainted with a considerable number of the species enumerated in the present paper.

In all, about 137 species are present in this collection, and they appear to have been taken generally in the more southern and warmer parts of the islands. A few more than twenty species described from other localities in the Empire are not among those here recorded, but they are only a small part of the ample fauna yet to be recognized when the various districts of the country shall have been closely examined.

Suborder HETEROPTERA.

Family ARTHROPTERIDÆ.

COPTOSOMA CRIBRARIA, Fabricius.

Coptosoma cribraria, FABRICIUS, Ent. Syst. Supp., p. 551.

Thirteen specimens are in this collection.

COPTOSOMA BIGUTTULA, Motschulsky.

Coptosoma biguttula, MOTSCHULSKY, Bull Soc. Moscow, 1859, p. 501.

Twenty-seven specimens of this form were taken.

Family SCUTELLERIDÆ.

CHRYSOCORIS GRANDIS, Thunberg.

Chrysocoris grandis, THUNBERG, Nov. Ins. Spec., 1783, p. 31.

Six specimens of two varieties are in the collection.

Subfamily GRAPHOSOMINA.

BOLBOCORIS RETICULATA, Dallas.

Bolbocoris reticulata, DALLAS, Brit. Mus. List, I, p. 45.

Four specimens were secured.

GRAPHOSOMA LINEATA, Linnæus.

Graphosoma lineata, LINNÆUS, Syst. Nat., 10 ed., p. 442.

Nineteen specimens are in the collection. The specimens from Japan vary in the width of the black stripes, and to a small degree in the structure of the genital segments of the male.

Subfamily EURYGASTRINA.

EURYGASTER MAURUS, Linnæus.

Eurygaster maurus, LINNÆUS, Fauna Suec., p. 246.

Eleven specimens variable in size and pattern of marking are at present in this collection.

Family CYDNIDÆ.

MACROSCYTUS JAPONENSIS, Scott.

Macroscytus japonensis, SCOTT, Ann. Mag. Nat. Hist., 1874, p. 294.

Three specimens are included in the collection.

ÆTHUS NIGROPICEUS, Scott.

Æthus nigropiceus, SCOTT, Ann. Mag. Nat. Hist., 1874, p. 294.

Fifteen individuals of this common insect were secured.

Family PENTATOMIDÆ.

Subfamily HALYDINA.

HALYOMORPHA PICUS, Fabricius.

Halyomorpha picus, FABRICIUS, Ent. Syst., IV, p. 115.

Eight specimens are in the collection.

Subfamily ASOPINA.

ZICRONA CŒURULEA, Linnæus.

Zicrona cærulea, LINNÆUS, Syst. Nat., 10 ed., p. 445.

Only a single specimen is present.

PICROMERUS LEWISI, Scott.

Picromerus lewisi, SCOTT, Ann. Mag. Nat. Hist., XIV, 1874, p. 5.

Two individuals are in the collection.

Subfamily ACANTHOSOMINA.

ACANTHOSOMA DISTINCTUM, Dallas.

Acanthosoma distinctum, DALLAS, Brit. Mus. List, I, p. 301.

Seven specimens were secured.

ACANTHOSOMA SCUTELLATA, Scott.

Acanthosoma scutellata, SCOTT, Ann. Mag. Nat. Hist., 1874, p. 301.

Five specimens are present in the collection.

CLINOCORIS GRAMINEUS, Distant.

Clinocoris gramineus, DISTANT, Trans. Ent. Soc. Lond., 1883, p. 426.

Five specimens of this form were also secured.

CLINOCORIS SIGNORETI, Scott.

Clinocoris signoreti, SCOTT, Ann. Mag. Nat. Hist., 1874, p. 303.

Three specimens only are present.

Subfamily PENTATOMINA.

TROPICORIS JAPONICUS, Distant.

Tropicoris japonicus, DISTANT, Entom. Month. Mag., 1882, p. 76.

Ten specimens are in the collection.

NEZARA VIRIDULA, Linnæus.

Nezara viridula, LINNÆUS, Syst. Nat., 10 ed., 1758, p. 444.

Nine specimens of two varieties were taken for this collection.

NEZARA ANTENNATA, Scott.

Nezara antennata, SCOTT, Ann. Mag. Nat. Hist., 1874, p. 299.

Nine specimens are in the collection.

ÆNARIA ASSIMULANS, Distant.

Ænaria assimulans, DISTANT, Trans. Ent. Soc. Lond., 1883, p. 421.

Eight specimens were secured for this collection.

ÆNARIA LEWISI, Scott.

Enaria lewisi, SCOTT, Ann. Mag. Nat. Hist., 1874, p. 296.

Eight specimens were placed in the collection.

DOLYCÓRIS SACCARUM, Linnæus.

Dolycoris saccarum, LINNÆUS, Syst. Nat., 10 ed., p. 721.

This common European species is represented here by three specimens.

EYSARCORIS PARVA, new species.

Grayish ivory-white, polished, short and broad, with the head, callosities, basal margin of scutellum, three short streaks at its apex, areas on the pleura, sides of venter, disk of tergum, punctures of upper surface and produced acute humeral angles, black. Head a little more deflexed at tip and more deeply emarginate than in *E. (Stollia) lewisi*, Distant; the surface closely confluently, at base coarsely, punctate, bronzed, and polished, the lateral margins acutely reflexed, tip of the tylus projecting a little, but hardly as long as the narrowed lateral lobes, at tip a little bristly, vertex with an ivory-white line at base; eyes deep seated; antennæ testaceous, the apical joint and the fourth, excepting its base, blackish, second joint much longer than the third, the fourth about equal to the second; rostrum testaceous, reaching upon the venter; the apical joint and a band across the third piceous. Pronotum punctured with black, in transverse series behind the middle, before the middle very remotely punctate, so as to leave the forward surface transversely pale and almost bare, an irregular black spot next each anterior angle, the lateral angles acuminate, curved, and bounded behind by a sinus in the protracted margin. Scutellum bluntly rounded, irregularly punctate with black, in each anterior angle is an oval ivory-yellow spot which is encircled by black punctures, and a patch of these punctures occupies the inner angle, middle of the outer margin and the tip each with a small black spot, the apical margin pale yellow. Wing-covers remotely punctate with black, yellow and bare on the costal border; membrane faintly dusky. Legs pale yellow, the femora and base of tibiæ minutely flecked with brown, the spines and spurs also brown, apex of tarsi piceous. Venter with a gradually narrowing black patch along the middle, and on each side a ragged obscure stripe which extends forward on the pleuræ, stigmatal orifices and a row of small spots on the connexivum black.

Length to end of venter, 5½–6 mm.; width across humeri without the spines, 4½ mm.

Type.—No. 3099, U.S.N.M.

A fine series of both sexes is present in this collection.

EYSARCORIS LEWISI, Distant.

Eysarcoris lewisi, DISTANT, Trans. Ent. Soc. Lond., 1883, p. 423.

Four specimens were placed in the collection.

RUBICONIA INTERMEDIA, Wolff.

Rubiconia intermedia, WOLFF, Icon. Cim., p. 182, pl. XVIII, fig. 181.

Fourteen specimens are present. This species is about as common in Japan as it is in some parts of Germany.

EURYDEMA RUGOSA, Motschulsky.

Eurydema rugosa, MOTSCHULSKY, Etud. Entom., 1861, p. 29.

Twelve specimens, including some varieties, are in the collection.

PLAUTIA FIMBRIATA, Fabricius.

Plautia fimbriata, FABRICIUS, Mant. Ins., II, p. 295.

Six specimens were secured for this collection.

MENIDA VIOLACEA, Motschulsky.

Menida violacea, MOTSCHULSKY, Etud. Entom., 1861, p. 23.

This appears to be an uncommon species. Only two specimens were secured.

ÆLIA FIEBERI, Scott.

Ælia fieberi, SCOTT, Ann. Mag. Nat. Hist., 1874, p. 297.

Only three specimens were secured.

Subfamily PHYLLOCEPHALINA.

GONOPSIS AFFINIS, Uhler.

Gonopsis affinis, UHLER, Proc. Acad. Phila., 1860, p. 224.

Seven specimens are in the collection.

Subfamily UROLABINA.

UROCHELA LUTEOVARIA, Distant.

Urochela luteovaria, DISTANT, Ann. Mag. Nat. Hist., 1881, p. 28.

Only three specimens were found.

UROSTYLIS STRIICORNIS, Scott.

Urostylis striicornis, SCOTT, Ann. Mag. Nat. Hist., 1874, p. 360.

Sixteen specimens were secured. It appears to be a common species in southern Japan.

Family COREIDÆ.

Subfamily MICTINA.

OCHROCHIRA FULIGINOSA, Uhler.

Ochrochira fuliginosa, UHLER, Proc. Acad. Phila., 1860, p. 225.

Four specimens are in the collection.

Subfamily HOMŒOCERINA.

HOMŒOCERUS PUNCTIPENNIS, Uhler.

Homœocerus punctipennis, UHLER, Proc. Acad. Phila., 1860, p. 226.

Eight specimens were secured.

HOMŒOCERUS CONCOLORATUS, Uhler.

Homœocerus concoloratus, UHLER, Proc. Acad. Phila., 1860, p. 225.

Seven specimens are in the collection.

HOMŒOCERUS MARGINATUS, new species.

Pale rufofulvous, long and moderately narrow. Head short, deeply incised behind the base of tylus, the antenniferous lobes with a red band; antennæ rufous, scabrous, as long as the interval from the tip of head to apex of fifth abdominal segment, apex of the second and third joints piceous, the base of the fourth pale yellowish, basal and second joints very long, the second longest, the third a little shorter than the basal one, rostrum yellow, black at tip, reaching to near the middle coxæ. Pronotum steeply sloping forward, paler than the wing-covers, transversely, wavedly rugulose, with confluent coarse punctures between the wrinkles, the lateral margins a little sinuated posteriorly, minutely denticulated along the slender black edge, lateral angles a little curved upward, black, acute, and minutely acuminate, posterior submargin obsoletely carinate. Legs honey yellow, tinged with green, apex of the tarsi piceous. Scutellum greenish yellow, more minutely punctate and rugulose than the pronotum. Hemelytra tinged with rufous, clavus very coarsely punctate, the corium with punctures becoming coarser posteriorly, costal margin a little dusky; membrane pale brownish testaceous, reaching the tip of tergum. Under side pale ocher-yellow, minutely scabrous; connexivum uniformly pale yellow.

Length to tip of abdomen, 20 mm.; width of base of pronotum, 6 mm.

Type.—No. 3103, U.S.N.M.

Only two specimens of this fine insect are present in the collection. The one is redder on the hemelytra than the other. Both are changed by the chemical agent which destroyed their lives, and there is strong evidence of the original color having been green on most of the surface before they had been placed in the collecting bottle.

Subfamily LYBANTINA.

PACHYCEPHALUS OPACUS, Uhler.

Pachycephalus opacus, UHLER, Proc. Acad. Phila., 1860, p. 226.

Only two specimens of this odd-looking insect are in this collection.

Subfamily GONOCERINA.

CLETUS BIPUNCTATUS, Herrich-Schæffer.

Cletus bipunctatus, HERRICH-SCHÆFFER, Wanz. Insekten., V, VII, p. 9, fig. 566.

Eighteen specimens were secured for this collection.

PLINACHTUS SIMILIS, new species.

Rust brown, infuscated above, fulvous beneath, form similar to *Ficana apicalis*, Dallas, but with almost rectangular, acute, slightly recurved humeral angles. Head black and densely granulated above, fulvous on the sides and beneath, coarsely, remotely punctate, middle line obsoletely carinate, face a little longer than the vertex behind the eyes, moderately tapering anteriorly, indented each side next the anteniferous lobes, tylus narrow, triangularly widened at base, a little longer than the lateral lobes, and separated from these lobes by a wide deep suture; rostrum stout, infuscated, reaching behind the anterior coxæ; antennæ stout, scabrous, black, as long as the head, pronotum and clavus united, the basal joint long and stouter than the second, the second longer, as long as the pronotum, the third a little shorter than the basal, the fourth thicker, acute at base and tip, a little shorter than the third. Pronotum closely granulate with black in transverse series, the surface steeply sloping toward the head, the lateral margins almost directly diagonal, behind the humeri bluntly diagonal, the posterior margin sinuate and protracted like a flap over the base of the scutellum, and with a transverse faint carina in advance of the basal margin. Scutellum punctate with black in transverse broken lines. Legs granulated and scabrous over most of the surface, black, femora yellow beneath for about two-thirds of the length from base. Hemelytra rust-brown, spread with sunken black punctures, the embolium and most of the costal margin fulvous; membrane dark brown, paler at base. Stigmatal orifices black; connexivum interrupted above with broad black bands.

Length to end of abdomen, 14½ mm.; width between the humeral angles, 6 mm.

Type.—No. 3104, U.S.N.M.

Only one specimen of this insect was secured. It is a male, and bears some resemblance to the common *Anasa tristis*, De Geer, of North America.

Subfamily CORIZINA.

CORIZUS HYALINUS, Fabricius.

Corizus hyalinus, FABRICIUS, Ent. Syst., IV, p. 168.

Thirteen specimens of this genus are in the collection, one form of which appears to be a new species. This is, however, too much altered for satisfactory description.

Family LYGÆIDÆ.

Division NYSIINA.

NYSIUS EXPRESSUS, Distant.

Nysius expressus, DISTANT, Trans. Ent. Soc. Lond., 1883, p. 429.

Seventeen specimens, of more than one variety, are present in this collection.

Division BLISSINA.

ISCHNODEMUS OBNUBILUS, Distant.

Ischnodemus obnubilus, DISTANT, Trans. Ent. Soc. Lond., 1883, p. 431.

Two specimens are in the collection.

Division GEOCORINA.

GEOCORIS VARIUS, Uhler.

Geocoris varius, UHLER, Proc. Acad. Phila., 1860, p. 229.

Fifteen specimens were secured.

Division MYODOCHINA.

PAMERA PALLICORNIS, Dallas.

Pamera pallicornis, DALLAS, Brit. Mus. List., II, p. 573.

Six specimens are in the collection.

PAMERA HEMIPTERA, Scott.

Pamera hemiptera, SCOTT, Ann. Mag. Nat. Hist., 1874, p. 27.

This appears to be a common species in southern Japan. Fourteen specimens were secured.

LETHÆUS LEWISI, Distant.

Lethæus lewisi, DISTANT, Trans. Ent. Soc. Lond., 1883, p. 440.

Only four specimens of this form were secured.

LIGYROCORIS TERMINALIS, new species.

Piceo-fulvous, punctate with black, almost spindle-shaped, flatter and more parallel-sided than normal. Head short, fusco-piceous, pubescent, with the occiput a little swollen, and an impressed line each side of middle between the ocelli and divaricating anteriorly; the surface a little rough and uneven, and the sutural lines bounding the tylus deeply defined; antennæ honey yellow, stout, a little shorter than the hemelytra, all but the last joint a little thickened at the tip, basal joint clavate, darker apically, about half as long as the second, the second

longest, piceous at tip, the third about two-thirds the length of the second, dark at tip, fourth dusky, pale at base, a very little shorter than the third; rostrum slender, reaching to the middle coxæ, flavo-testaceous, darker at base, the apical joint piceous. Pronotum sub-triangular, the anterior lobe flattened and depressed, infuscated, pubescent, remotely punctate, with the lateral margin reflexed inferiorly, collum reflexed, posterior lobe obscure fulvous, larger than the anterior lobe, moderately convex, sparsely punctate with fuscous, the lateral margins interruptedly reflexed, with the humeral angles knobbed and margined exteriorly by a groove, posthumeral lobes thick, testaceous; pro-pleura piceous in the middle, meso- and meta- dark piceous, feebly punctate. Legs fulvo-testaceous, the coxæ pale at tip, the femora darker apically, punctate, tibiæ paler, tarsi piceous at tip, the anterior femora armed beneath with two long spurs and one short tooth. Scutellum rufocastaneous, depressed and punctate at base, carinate and paler at tip. Clavus flavo-testaceous, marked with three incomplete lines of punctures; corium flavo-testaceous, obsoletely punctate with brown and with coarse brown punctures on the sutures; the cuneus whitish, pale piceous at tip, punctate exteriorly; costal margin strongly sinuated, pale testaceous; membrane brown; paler at tip and with interruptedly pale veins, particularly at base. Abdomen pale fulvous.

Length to tip of abdomen, 7½ mm.; width of pronotum, 1¾ mm.

Type.—No. 3113, U.S.N.M.

Only two specimens of this insect are present in this collection.

EREMOCORIS PLANUS, new species.

Dull piceous-black, with the pronotum a little longer than wide and only a little narrower anteriorly, with the lateral margins strongly reflexed and testaceous. Head a little longer than the anterior lobe of pronotum, minutely scabrous, a little piceous at tip; antennæ stout, the joints pale at base, the second joint a little longer than the others, the basal joint thick and shortest; rostrum slender, fulvo-testaceous, black at tip, reaching to the middle coxæ. Pronotum sparsely punctate, dull blackish on the anterior lobe, and this has an indented dot each side of middle, anterior angles slightly rounded, posterior lobe obscure testaceous, punctate, feebly sinuated on the lateral margin adjoining the transverse suture, the posthumeral margin with a depressed lobe. Scutellum piceous, remotely punctate, depressed in the middle between a Y shaped carina which is protracted to end of apex. Corium dull blackish, with a large testaceous spot at base, deeply remotely punctate with black, base and apex of cuneus more or less testaceous, apex of clavus sometimes testaceous; membrane blackish-brown. Legs piceous, the tibiæ generally paler. Venter black, polished.

Length to tip of venter, 5–5½ mm.; width of pronotum, 2¼–2½ mm.

Type.—No. 3114, U.S.N.M.

Four specimens belong to this collection.

Division PACHYGRONTHINA.

PACHYGRONTHA SIMILIS, new species.

Pale dusky testaceous, punctate with dark brown, more or less suffused with brown on the anterior portion of the pronotum. All the margins of the pronotum and the middle line which is abbreviated and more slender behind, an oblong diagonal spot in each basal angle and the carina of the apex of scutellum, exterior border of corium, and of the abdomen ivory yellow. Antennæ as long as the head, pronotum and corium united, honey yellow, minutely punctate with brown, the apex of the basal joint clavate and made black by the aggregation of punctures, second and third joints short, the third a little shorter, together about equal to the basal, the third nigro-piceous except the base, the fourth much shorter, nigro-piceous. Head roughly punctate with piceous in longitudinal series, the middle line and depressed border near the eyes pale and smooth, pubescence minute; rostrum mostly piceous, pale at base, reaching behind the anterior coxæ; throat unevenly granulate and punctate with piceous. Pronotum long, coarsely punctate with dark brown in transverse series, branded with piceous each side of the callous middle line, suture separating the lobes not deeply impressed, placed a little farther back and more distinct in the males, lateral margin reflexed, callous, the humeri with a piceous oblong callosity next the border; propleura evenly punctate with piceous, meso and meta pleura darker and more densely punctate. Anterior femora very thick, appearing piceous by reason of the numerous blackish punctures, armed with four larger teeth tipped with black and numerous smaller black teeth between them, anterior tibiæ short, curved, lineated with black punctures, the other femora and tibiæ punctate with black, tips of tarsal joints piceous. Corium with a broad pale border, the costal area with one complete series and another half series of brown punctures, the tip linearly callous, pale, and having a minute brown dot at tip, and a larger one next the inner angle of membrane and a piceous thick line at tip of clavus, surface of both corium and clavus remotely punctate with brown in lines. Venter opaque, marked with a broad black vitta each side and with some spots along the middle and at tip.

Length to tip of abdomen, 7–8 mm.; width of pronotum, $1\frac{3}{4}$–2 mm.

Type.—No. 3100, U.S.N.M.

PACHYGRONTHA ANTENNATA, Uhler.

Pachygrontha antennata, UHLER, Proc. Acad. Phila., 1860, p. 229.

Six specimens were secured for the collection.

Division HETEROGASTRINA.

CHAULIOPS FALLAX, Scott.

Chauliops fallax, SCOTT, Ann. Mag. Nat. Hist., 1874, p. 428.

Three specimens of this peculiar species were collected.

Division LYGÆINA.

AROCATUS MELANOSTOMA, Scott.

Arocatus melanostoma, SCOTT, Ann. Mag. Nat. Hist., 1874, p. 21.

Only two specimens of this species were secured.

Subfamily LARGIDÆ.

PHYSOPELTA GUTTA, Burmeister.

Physopelta gutta, BURMEISTER, Nova Acta Acad. Leopold, XVI, 1834, Supp., p. 300, pl. XLI, fig. 10.

Two exceedingly large specimens of this species are present with four smaller varieties. This exceptional growth in size is recognized as a well-established fact in many other insects of Japan.

Family TINGIDÆ.

GALEATUS PECKHAMI, Ashmead.

Sphærocysta peckhami, ASHMEAD, Ent. Amer., III, p. 156.

Four specimens were secured. I can find no structural differences to separate these from the veritable type as it occurs in lower Canada.

TINGIS PYRIOIDES, Scott.

Tingis pyrioides, SCOTT, Ann. Mag. Nat. Hist., 1874, p. 440.

Four specimens are in the collection. This form belongs to the subgenus *Stephanitis* as established for European species by Dr. Stål.

CANTACADER LETHIERRYI, Scott.

Cantacader lethierryi, SCOTT., Ann. Mag. Nat. Hist., 1874, p. 443.

Four specimens were secured. It belongs to the well-distinguished division of the genus as recognized by Dr. Stål and later entomologists.

Genus PHYLLONTOCHILA.

PHYLLONTOCHILA DEBILE, new species.

Pale testaceous, marked with chestnut-brown, somewhat similar in form to *Monanthia dentata*, Fieber. Head narrow, pale chestnut-brown, pale each side, and with a short, pale, carinate process in front, superiorly; antennæ long and slender, with the apical joint fuscous; clypeus blackish-piceous, eyes brown. Pronotum wider than long, narrower than the base of hemelytra, opaque, with indistinct and small meshes; the hood wedge-shaped, narrow, directed straight forward to about the front of head; lateral wings nearly half as wide as the dorsal convexity, anteriorly produced, tapering forward, not quite as far as the hood, traversed by about four series of meshes; dorsal surface pale brownish, with small obscure meshes, and a pale middle-carinate line, which is

continued to tip of scutellum. Hemelytra gradually narrowing posteriorly, oval, with small meshes on the basal and discoidal areas and larger ones on the lateral areas and membrane; discoidal field a little dusky, so also the thick median vein and a quadrate spot before the middle of costal area; veins of membrane more or less dusky apically, about three to four series of meshes to the costal area. Legs testaceous, the tarsi black at tip. Abdomen blackish.

Length to end of wing-covers, 3¾ mm.; width across middle of pronotum and the expansions, 1¼ mm.; width of base of wing-covers, 1½ mm.

Type.—No. 3117, U.S.N.M.

Only two specimens of this interesting species occur in this collection.

Family CAPSIDÆ.

LYGUS SIMPLUS, new species.

Flavo-testaceous, polished, tinged with ocherous and rufous, form of *L. sallei*, Signoret, coarsely punctate with brown over most of the upper surface. Head highly polished, moderately short, ocherous, vertex convex, compressed each side at base and on the middle, the occipital collar black, eyes large, extending beyond the width of pronotum; face directed obliquely, cheeks narrow, testaceous, tylus short, narrow, prominent; rostrum reaching to the middle coxæ, testaceous, darker at tip; antennæ a little longer than the coriaceous part of the hemelytra, mostly blackish-brown, with the second joint paler, and the basal joint rufoflavous, the second joint longer than the two apical ones united, pale at base, a little thickened apically, the third a little longer than the fourth, both filiform. Pronotum strongly convex, coarsely and not closely punctate, a little wider than long, the collum white, lateral margins smooth, curved, projecting over the large pleural flaps, the callosities of anterior lobe united into a prominent, polished tumidity of a piceous color, posterior margin depressed, sinuated against the base of scutellum, then curved each side, the edge pale and before it a fuscous, submarginal, incomplete line; pleural pieces bordered with white; sternum fuscous. Legs tinged with rufous, the tibiæ paler, piceous at apex and at end of tarsi. Scutellum convex, highly polished, pale rufocastaneous, sparsely punctate, testaceous at tip and on the lateral edges. Clavus tinged with fuscous, corium obsoletely punctate on the disk, tinged with fuscous toward the inner and outer borders and on the costal edge; membrane tinged with brown, and with a pale spot next the cuneous. Venter rufoflavous, a little piceous near the apex.

Length to end of venter, 6 mm.; width of pronotum, 2½ mm.

Type.—No. 3116, U.S.N.M.

Two specimens of this insect are present in the collection.

CALOCORIS VARIABILIS, new species.

Closely related to *C. seticornis*, Illiger, of Europe. Oval, moderately robust, polished, not distinctly punctate, most specimens deep black, with a yellow forked streak running from base over most of the clavus, the other limb extending along the costa until it connects with the yellow or orange cuneus. Head black, mostly polished, with a short neck behind the eyes, which are sometimes marked with a slender yellow band, front strongly convex, the middle sometimes with a round greenish spot, space beneath the antennæ often pale; eyes brown, almost orbicular; rostrum piceous black, slender beyond the basal joint, reaching behind the middle coxæ; antennæ moderately thick, black, longer than the entire body and hemelytra united, the second and third joints very long, the second about as long as the clavus, the third a little shorter, the fourth much shorter. Pronotum polished, a little scabrous, with a few obsolete punctures near the suture, middle of the suture with a fulvous dot, lower margin of the propleura whitish, humeri rounded, mesopleura slenderly margined with white, the metapleura with a white triangular spot above the coxa. Legs black or obscure yellow, the tibiæ often obscure yellow with black spines, while the femora are black. Scutellum sometimes tipped with yellow. Hemelytra minutely pubescent, membrane smoky black. Venter pitch black.

Length to tip of abdomen, 6–7½ mm. Width of pronotum, 2½–3 mm.

Type.—No. 3102, U.S.N.M.

Ten specimens were present in the collection. The female is sometimes uniformly black above and mostly so beneath. A variety has the legs pale fulvous and the antennæ fulvous, with the bases of the two apical joints white. A male is yellow, with two black dots on the pronotum and black spots on the tergum, while the antennæ are yellow, and the legs reddish yellow.

DICYPHUS LAUTUS, new species.

Elongate, subcylindrical, moderately robust, ivory whitish or pale yellow. Head suborbicular, with a contracted neck, which is scarcely longer than the eyes, and sometimes pale testaceous; vertex black at base, bounded in front by a yellow band; face dusky, bordered all around with black or brown; rostrum yellow, black at base, reaching to the posterior coxæ; antennæ long and slender, black, the basal joint rufopiceous, whitish at base, hardly half as long as the second, the second gradually thickening in the direction of the apex, the third abruptly slender, pale at base, much longer than the apical one; pronotum dull yellow, the anterior lobe very short and narrow, behind the collum transversely dusky and of the same color below; posterior lobe very convex, with a broad black curved submarginal spot, which is

interrupted on the basal middle and does not cover the humeral area; disk with a round black spot, lower lateral border bright yellow; sternum yellowish white; mesopleura bright orange; legs long and slender; the femora deep orange and crossed by one or two pale bands; tibiæ pale yellow, piceous at tip; tarsi piceous at tip. Scutellum inflated, greenish yellow, with a black spot each side, another at base, and one at tip; clavus orange, blackish at base, on the inner margin, and on the tip, the outer margin deep black; corium whitish, with a large, angular orange area running from the middle of the disk back to near the inner angle with a triangular termination, the base of this spot bounded by a black band, which keeps out to near the costal margin, another black band crosses the whole width at base of cuneus, and the cuneus is broadly margined along the inner side with black; membrane mostly dusky black, the veins blacker interior of cell, a spot next the outer border, a slender scalloped transverse band across the apical margin of the cells and cunei white; tergum black, with a yellow stripe each side; venter yellow, somewhat blackish on the middle of connexivum.

Length to tip of abdomen, 5·6 mm.; width of base of pronotum, 2 mm.

Type.—No. 3101, U.S.N.M.

Nine specimens of this beautiful species are present in the collection. Both sexes are represented.

Family NABIDÆ.

CORISCUS TAGALICUS, Stål.

Coriscus tagalicus, STÅL, fugen. Resa. Ins. p. 261.

Ten specimens are present in the collection.

METATROPIPHORUS TABIDUS, new species.

Narrow, subcylindrical, pale testaceous, form narrower than *Coriscus capsiformis*. Head highly polished, chestnut brown, less brown behind the eyes; antennæ setaceous, very slender throughout, nearly one-half longer than the body, dusky, a little darker at the tips of the first two joints; clypeous gradually narrowing toward the apex, dark piceous at base, paler at tip, very moderately curved; rostrum slender, reaching almost to the middle coxæ, testaceous obscured with brownish. Collum narrow, white, the anterior lobe of pronotum very convex, polished, chestnut brown, much shorter and somewhat narrower than the posterior lobe, constricted behind, the posterior lobe subtriangular, distinctly punctate, dull, with the middle line and lateral margins pale testaceous, posterior middle impressed, the humeri prominent; propleura testaceous, brown above, meso and meta pleura piceous; coxæ and legs yellowish testaceous, spines of femora and tibiæ brown, apex of tarsi piceous. Scutellum a little punctate, pale chestnut brown, testaceous at tip. Wing covers testaceous, clavus tinged with brownish, slightly punctate, the coarse bounding lines piceous, veins piceous,

the corium dusky on the disk and with a large dusky patch near the tip; membrane longer than the abdomen, clouded with dusky. Tergum blackish on the disk, pale on the connexivum; venter testaceous.

Length to tip of abdomen, 5½–6 mm; width of pronotum, 1¼ mm.

Type.—No. 3112, U.S.N.M.

Only three specimens of this species were secured.

Family REDUVIIDÆ.

PTILOCERUS IMMITIS, new species.

Form of and closely related to *P. fuscus*, Gray; dull pale yellowish brown tinged with fuscous; densely hairy; tip of clavus with a black dot, and base of cuneus with an oblong black spot, outer border behind this spot yellow; membrane large and soot-black. Hairs of antennæ long and slender, gradually growing shorter toward the tip.

Length to tip of venter, 6 mm.; width of pronotum, 2 mm.

Type.—No. 3115, U.S.N.M.

Two specimens of this peculiar insect are in the collection.

VELINUS NODIPES, Uhler.

Velinus nodipes, UHLER, Proc. Acad. Phila., 1860, p. 230.

Eight adult and three undeveloped specimens are in the collection.

HARPACTOR ORNATUS, new species.

Jet black, polished, robust, sparsely hoary pubescent. Head moderately short, a little inflated behind the eyes, the occipital portion forming a short neck, space between the ocelli yellow and sunken, face and clypeus tapering anteriorly, together a very little longer than the division behind the eyes; antennæ black, slender, as long as the abdomen and posterior lobe of pronotum; rostrum thick, black, reaching almost to the anterior coxæ. Pronotum broad, the lateral margins of posterior lobe broadly reflexed, rufous, the posterior margin narrowly rufous, middle line broadly grooved, the anterior lobe deeply excavated, ridges each side high and curved; supra-coxal border above the fore legs ivory yellow, meso-pleural border narrowly yellow. Legs black, the femora thick and somewhat knobby. Scutellum polished like the pronotum, deeply sunken at base. Hemelytra entirely deep black, the membrane barely longer than the abdomen. Outer border of the abdomen broadly rufous, the remaining surface black, highly polished.

Length to tip of abdomen, 13–14 mm.; width of pronotum, 4 mm.

Type.—No. 3107, U.S.N.M.

Four specimens of this species are in the collection. The male is a little smaller than the female, has the posterior red border of the pronotum wider, and the same color of the connexivum waved on the inner margin.

PROCERATES, new genus.

Form of a broad *Harpactor*, but with the head short and wide before the eyes, incised between the eyes, with a stout spine at base of each antennal lobe, the space between them excavated, anterior lobe much shorter and a little narrower than the posterior one, convexly elevated, neck short and thick, clypeus bluntly rounded, the rostrum thick, reaching between the anterior coxæ, with its basal joint longer than the two others united; antennæ of medium length, the basal joint as long as the second and third united, the third much shorter than the second. Abdomen broad oval, thin, wider than and shorter than the wing-covers. Sides of prosternal groove lamellar. The venation and other characters are like *Harpactor*.

PROCERATES RUBIDA, new species.

Cinnabar red, smooth, and polished, with the upper surface minutely scabrous. Antennæ, excepting the basal lobe, legs, membrane, two apical joints of rostrum, sides of throat, disks of pleural lobes, and four short bands on the first four ventral segments black, surface, both above and below, a little pubescent. Eyes brown. Tips of spines of head black. The amount of black on the pectoral pieces and venter varies in the different individuals. Lateral angles of pronotum relieved.

Length to end of abdomen, 11–14 mm.; width of pronotum, 3¼–4 mm.

Type.—No. 3109, U.S.N.M.

Six specimens of this brightly colored species were secured for this collection. The males are much narrower than the females.

LARYMNA HÆMATOGASTER, Burmeister.

Larymna hæmatogaster, BURMEISTER, Nova Acta Leopold, XVI, 1834, Supp., p. 301.

Eight specimens of this variable species were secured.

SPHEDANOLESTES IMPRESSICOLLIS, Stål.

Sphædanolestes impressicollis, STÅL, Stettin. Ent. Zeit., XXII, 1861, p. 147.

Eight specimens are in this collection.

HAEMATOLŒCHA NIGRO-RUFA, Stål.

Haematolœcha nigro-rufa, STÅL, Ofv. Akad. Forh., 1866, p. 301.

Two specimens are the only ones in the collection.

PIRATES SINICUS, Walker.

Pirates sinicus, WALKER, Brit. Mus. Cat. Heteropt., Pt. VII, 1873, p. 121.

Seven specimens of variable pattern of coloring are in the collection.

ONCOCEPHALUS SQUALIDUS, Rossi.

Oncocephalus squalidus, ROSSI, H. Schf. Wanz. Ins., VIII, p. 93, fig. 861.

Two specimens of the brachelytrous form of this well-known European species are in the collection.

ACANTHODESMA, new genus.

Somewhat resembling *Sulyavata*, but is a true member of the family *Stenopodidæ*. Form elongate suboval, with a long spine each side behind base of antennæ, and surface of head with numerous spines on the crown and sides; head short, longer behind the eyes than before them, bristly, carinated on the middle line; antennæ slender, but not setaceous, as long as the body without the head, basal joint very short, second as long as the pronotum and head together, third and fourth together about equal to the second, but thinner and filiform, rostrum very stout, a little curved, the basal joint longer than the others conjoined, the apical joint touching the space between the anterior coxæ. Pronotum bristly hirsute, subtrapezoidal, a little longer than wide, the anterior lobe much shorter than the posterior one, deeply sunken along the middle and sinuated next the head, with the anterior angles carinate and a little produced, behind each angle a long, erect spine followed behind by three or more shorter ones; posterior lobe with a ridge each side and a wide deep groove on the middle line, followed behind by a shallow, depressed, wide area which is terminated each side before the base by a long erect spine, middle of each lateral margin with a spine, humeral angles with a longer oblique spine. Femora with series of strong spines both below and above, tibiæ with bristles and very slender spines, the anterior pair with two series of oblique, long spines, middle tibiæ much shorter than the others. Scutellum longer than wide, sinuated each side behind the middle, with the margins callous and reflexed, spinous and with a long spine each side and at tip, veins of corium slender, long, forked, and slightly divaricating posteriorly, veins of the membrane long, the middle ones twice forked, the divaricating branches running backward instead of toward the tip. Margin of abdomen close set with spines, one series of which consists of a few longer ones, apex of venter with a long spine each side and in the male two approximate slender spines on the middle of the tip, apical margin of the female with six short ones between the two outer spines.

ACANTHODESMA PERARMATA, new species.

Pale dull grayish-yellow, with the spines, the middle line of head, sides of face, pubescence, carinate edge, and lines of pronotum and scutellum and line bounding the connexivum whitish yellow. Antennæ dusky yellow, the second joint thicker than the others and armed with series of stiff bristles. Tips of spines black, acute. Pronotum clothed with shaggy pubescence, median depression margined with acute carinæ, the surface next outside of these ridges broadly and less deeply, longitudinally, channeled, lateral margin with a slender raised line, posterior margin truncated, a pale line runs back from each of the two middle posterior spines. Scutellum with long hairs, margined with pale testaceous. Lower border of pleura, and the matted hairs,

pale. Wing-covers pale inwardly, the membrane correspondingly pale and with dark veins, the middle longitudinal vein thick, prominent, pale, darker toward the tip, the costal and vein bounding the inner side of costa thick, dark, pale at base. Connexivum pale, marked before the tip with a fuscous streak and next the tip with a similar curved streak; sides of venter with pale and brown alternating lines which are less distinct toward the disk.

Length to tip of abdomen, 10–11 mm.; width of pronotum, 2–2½ mm.

Type.—No. 3108, U.S.N.M.

A male and female are the only specimens of this form present in the collection. This insect deserves special attention from the unusual number of attachments to the several parts of its organs. It should be studied in its different stages to ascertain the meaning of the peculiar elements of structure which appear in the adult form.

Subfamily EMESINA.

ORTHUNGA BIVITTATA, new species.

Pale yellowish testaceous with an ashy tinge, long and more robust than *Stenolemus* which it much resembles. Head highly polished and brown between the eyes, anterior lobe short, prominently convex, eyes brown, posterior lobe longer, gradually contracting posteriorly; clypeus narrow, pale testaceous; antennæ setaceous, much longer than the body, tinged with brown; rostrum reaching behind fore coxæ, thick on the two basal joints, both of these brownish and paler on the ends, the second shorter than the basal, swollen, the third abruptly more slender, acute. Pronotum bicampanulate, emarginate, and inflated anteriorly, constricted in the middle, more than twice as long as the head, brownish, polished, lineated with two whitish stripes which run parallel with the varying outline of the two lobes and connected on the front margin of the anterior lobe by a transverse whitish band, the posterior lobe much wider than the anterior one, and with the humeral angles tumidly prominent, lateral margins also whitish. Posterior pairs of legs long, very slender, pubescent, the femora twice banded with brown, the tibiæ paler at base, fore legs short, the femora subfusiform, armed beneath with slender spines tipped with black coxæ with two dusky bands. Scutellum pale brownish, the basal lobe tumido-convex. Wing-covers pellicular, whitish translucent, widening and curving posteriorly, with brown veins. Abdomen dusky, pubescent, subcylindrical and thicker posteriorly.

Length to end of abdomen, 16½ mm.; to tip of wing-cover, 17½ mm.; width of base of pronotum, 2 mm.

Type.—No. 3110, U.S.N.M.

Only one specimen of this spider-resembling insect is present in the collection.

EMESA MARCIDA, new species.

Slender, moderately short, dull yellowish testaceous, the sides with a slender black line throughout, including the head. Antennæ exceedingly slender, a little shorter than the body; head about half as long as the anterior division of the pronotum, a slender reddish-brown line each side of middle, the vertex and front of nearly equal length and width; eyes very small. Thorax, dusky each side, and with a slender red line along the middle. Anterior femora with a blackish line each side inferiorly, and a red line above, armed beneath with long and short black-tipped teeth; tibiæ about one-third the length of femora, dusky at base and tip; tarsi slender, dusky at tip. Wings not present. Middle and posterior femora twice banded with dusky near the tip; tibiæ with four dusky bands basally. Tergum with two slender black lines, and two red lines exterior to the others, angles of the segments with piceous nodes; venter more or less dusky.

Length to end of abdomen, 18 mm.; width of pronotum, $\frac{3}{4}$ mm.

Type.—No. 3111, U.S.N.M.

Three specimens are in the collection. They seem to be nymphæ, and have no vestige of wing-covers.

Family HYDROMETRIDÆ.

LIMNOBATES VITTATA, Stål.

Limnobates (*Hydrometra*) *vittata*, STÅL, Hem. Iresul. Philipp, p. 705.

Eight specimens of this neat and slender species were placed in the collection.

Family HYDROBATIDÆ.

HYGROTRECHUS REMIGATOR, Horvath.

Hygrotrechus remigator, HORVATH, Ent. Soc. Brux. C. R., 1879, p. cix.

Six specimens of this insect are in the collection.

LIMNOTRECHUS ELONGATUS, new species.

Olivaceous blackish-brown, opaque, elongated. Head moderately long, gently curving before the eyes, occipital lobes large, entering the sinus of the eyes and bounded inwardly by a curved, fulvous, impressed line which crosses the middle; eyes hemispherical exteriorly, bounded by a fulvous line interiorly, front bilobed, indented each side behind, and with a slight knob before each indentation; apex of face fulvous, coated with silvery, rostrum reaching behind the anterior coxæ, brown, pale fulvous at base, the short apical joint black; cheeks mostly yellow, the throat silvery whitish; antennæ brownish-black, very slender, as long as from the tip of face to the end of posterior coxæ, basal joint as

long as the posterior lobe of the pronotum without the scutellum, second joint a little more than one-half the length of the first, the shorter, the fourth slenderly tapering, nearly as long as the second. Pronotum depressed, strongly carinated, slenderly margined with yellow and with a yellow stripe on middle of anterior lobe, posterior lobe uneven, the exterior margin and middle line black; scutellum rusty-fulvous behind, bounded by a reflexed black margin; humeral angles tumid, blackish, broadly bordered exteriorly with yellow; pectus grayish silvery, the antepectus entirely yellow. Coxæ with a large yellow spot, trochanters and base of femora also yellowish; pleura with a continuous broad black stripe superiorly. Legs very long, blackish-brown. Hemelytra a little shorter than the abdomen, brown, with the veins black. Tergum black, with the exterior raised margin yellow, the apical portion with two pale lines, the genital segments margined with fulvous, apical processes slender, a little longer than the genital segments; venter bluish-gray, with a stout fulvous carina on the middle line, the last segment deeply excavated, bordered with fulvous, the two genital segments fulvous and hairy; the lateral submargin interruptedly black posteriorly.

Length to end of venter, 23 mm.; width of pronotum, 3½ mm.

Type.—No. 3105, U.S.N.M.

Two males are in the collection.

Family NEPIDÆ.

LACCOTREPHES JAPONENSIS, Scott.

Laccotrephes japonensis, SCOTT, Ann. Mag. Nat. Hist., 1874, p. 430.

Four specimens are in the collection from southern Japan.

RANATRA CHINENSIS, Mayr.

Ranatra chinensis, MAYR, Novara Reise, Hem., p. 191, pl. v, fig. 59.

One specimen agreeing exactly with types from China is in the collection.

RANATRA BRACHYURA, Horvath.

Ranatra brachyura, HORVATH, Termesz. Frozetek., 1879, III, p. 10, No. 73.

A broken specimen is in the collection.

Family BELOSTOMATIDÆ.

BELOSTOMA DEYROLLII, Vuillef.

Belostoma deyrollii, VUILLEF, Ann. Soc. Ent., France, 1864, p. 141.

Three specimens are present. This is a common species in the waters of southern Japan.

APPASUS JAPONICUS, Vuillef.

Appasus japonicus, VUILLEF, Ann. Soc. Ent., France, 1864, p. 141.

Two specimens of this common species are in the collection.

Family NOTONECTIDÆ.

NOTONECTA TRIGUTTATA Motschulsky.

Notonecta triguttata, MOTSCHULSKY, Etud. Entom., 1861, p. 24.

Only a single specimen is in the collection, but it is not rare in southern Japan.

ANISOPS SCUTELLARIS, Billbg.

Anisops scutellaris, BILLBG, Herrich-Schæffer, Wanz. Ins., IX, p. 41, pl. CCXCIV, fig. 906.

Two specimens are in the collection.

Genus CORISA.

CORISA SUBSTRIATA, new species.

Dark brown above, testaceous on the head and beneath, form of *C. striata*, Fieber. Head moderately blunt, the vertex wide, coarsely carinated, and with an acuminated, brown callosity on the middle of the posterior margin, each side of the carina is an impressed, punctate line, another near the eye and an indentation, each side, next the occipital reflexed border; face moderately convex, hairy below, highly polished. Pronotum dark brown, moderately short, triangularly rounded behind, radiated, crossed by seven somewhat curved, slender yellow lines, of which the two discoidal ones are sometimes interrupted at the inner end apex with a very short yellow line, the margins dark brown, the middle anteriorly with a short callous carina, the lateral pieces narrow triangular, ivory white. Legs pale testaceous, fringe of the posterior tarsi blackish, palæ of the male narrower than in the female, falcate, a little curved toward tip, with the tibiæ thick and curved. Wing-covers, dark brown, rastrate, base of clavus crossed by about six yellow, nearly entire and straight lines, the remainder is marked with short wavy bands decreasing to a single series toward tip; corium with two or three series of well separated wavy bands; membrane with the flexed bands shorter, less regular, and more widely separated, sutures all pale yellow; embolium yellowish white, terminated by an aggregation of blackish marks in a long spot which is connected with a slender series of points which sometimes extend back to near the base. Venter pale testaceous. Facial fovea of the male subtriangular, short, narrow, shallow.

Length to tip of abdomen, 5½–6 mm.; width of pronotum, 2 mm.

Type.—No. 3106, U.S.N.M.

Fourteen specimens are present in this collection. One of these has a black stripe on the vertex.

Suborder HOMOPTERA.

Family CICADIDÆ.

PLATYPLEURA REPANDA, Linnæus.

Platypleura repanda, LINNÆUS, Syst. Nat., 12 ed., p. 707.

Nineteen specimens of this common but showy species are in the collection.

POMPONIA JAPONENSIS, Distant.

Pomponia japonensis, DISTANT, Monog. Orient. Cicad., 1892, p. 102.

Nine specimens are in the collection.

POMPONIA MACULATICOLLIS, Motschulsky.

Pomponia maculaticollis, MOTSCHULSKY, Bull. Soc. Nat. Moscow, 1866, p. 185.

Five specimens were secured for this collection.

COSMOPSALTRIA OPALIFERA, Walker.

Cosmopsaltria opalifera, WALKER, Brit. Mus. List Homopt., I, p. 56, No. 16.

Ten specimens of this fine insect grace the collection.

CRYPTOTYMPANA PUSTULATA, Fabricius.

Cryptotympana pustulata, FABRICIUS, Ent. Syst., IV, p. 20, No. 11.

Nine specimens of this common Chinese species are in the collection.

TERPNOSIA PRYERI, Distant.

Terpnosia pryeri, DISTANT, Monog. Orient. Cicad., 1892, p. 139, pl. XV, fig. 5.

Twelve specimens were placed in the collection.

GRAPTOPSALTRIA COLORATA, Stal.

Graptopsaltria colorata, STÅL, Berlin, Ent. Zeit., 1866, p. 169.—DISTANT, Monog. Orient. Cicad., p. 25, pl. II, fig. 8.

Nine specimens were taken for this collection.

MELAMPSALTA RADIATOR, new species.

Form of *Cicada montana*, Hagen, but a little broader, more generally covered with silvery whitish scales, which easily rub off, and with the apical valvular ventral segment of the male short, ovate, not tapering at tip, and with the opercula longer, forming curved lobes which approach but do not touch on the middle line of venter. General surface black, polished, with the venter pale fulvous. Vertex a little broader than long, with the apex and base each with a yellowish spot, the latter being placed in an oval cavity, the supra-antennal lobes narrow, testaceous, front moderately blunt, broadly margined with yellow, sulcate

on the middle line above, and over this is a large yellow spot, the transverse carinate lines and grooves distinct, rostrum black, reaching to the middle coxæ. Legs greenish, with the base and apex of femora and some lines along their surface, knees, tips, and sometimes the middle of tibiæ, base and tip of tarsi, besides the nails, and the three spines of anterior femora, black, the inner spine much longer than the others. Pronotum bordered behind and on the sides with greenish yellow, mesonotum with a deltoid yellow spot each side of disk, connecting with a slender line which continues back to the borders of the cross, and from thence on the posterior and lateral carinate borders. Wing-covers with large and often irregular meshes, the apical series beginning with a moderately short triangular one, and followed by longer curved ones to the inner bend of the margin, the costal vein greenish yellow, veins dark brown, yellow basally, and including the membranes, wings with brown veins, the inner area striped and margined with smoke brown, the basal membrane reddish, a streak (margined with fuliginous) running out from it, pale plumbeous. The *inner alulet* is large, ovate, bounded by a coarse vein, and traversed by numerous long veins. Abdomen long and narrow, with middle of venter striped with a series of black spots.

Length to tip of abdomen: Male, 20 mm.; female, 22 mm. Spread of wing-covers, 55–57 mm.

Type.—No. 3105, U.S.N.M.

Nine specimens of this interesting form are in the collection. The female has a much longer and more slender spur at apex of the tergum than in the male. In this species the two ulnar veins are separated at their origin on the angle of the basal areole, and the inner alulet (*schlussfeld*) of the wing is broadly rounded and traversed by eight or more very slender veins, forming long areoles.

Family FULGORIDÆ.

Subfamily RICANIIDA.

RICANIA EPISCOPALIS, Stål.

Ricania episcopalis, STÅL, Ofv. K. Vet.-Akad. Forh., 1865, p. 162, No. 5.

Fifteen specimens of this showy species are in the collection.

RICANIA ALBOMACULATA, new species.

Similar to *Ricania fuscata*, Fabricius, but the wing covers shorter and more bluntly rounded at apex, paler smoke-brown, with a subtriangular, ragged white spot near the middle of the costal margin. Vertex short, the anterior margin acutely carinate, especially at the angle next the eye; front rusty brown, a little wider than high, flat, carinate on the middle line, with the lower part of lateral margin curved and the inferior margin concave, each side near superior margin is an obsolete

curved line, epistoma pale orange-yellow, the rostrum still paler, reaching to the middle coxæ. Notum brownish-black, opaque, with a carina on the middle extending to the tip of scutellum. Under side and legs pale brownish. Venation of wings close, like that of *R. fuscata*, Fabricius. Abomen brownish, paler at base.

Length to end of abdomen, 7–8 mm. Expanse of wing covers, 23–26 mm.

Type.—No. 3122, U.S.N.M.

Fourteen specimens are in the collection. They exhibit very slight variation, and that appears to be due to maturity of coloration. This consists of greater depth of tint and thicker coating of bluish bloom. The segments on the dorsal line of abdomen are a little callous and produced over the sutures. In a few specimens the wings are paler than the wing-covers.

Subfamily FLATIDA.

PŒCILOPTERA DISTINCTISSIMA, Walker.

Pœciloptera distinctissima, WALKER, Brit. Mus. List, Supp., p. 114.

Fifteen specimens of this delicate green insect adorn the collection.

Subfamily DICTYOPHARIDA.

DICTYOPHARA INSCRIPTA, Walker.

Dictyophara inscripta, WALKER, Brit. Mus. List, Hompt., I, p. 322, No. 38.

Six specimens are in the collection.

ORTHOPAGUS, new genus.

This is a long and narrow form with a more open venation than in *Dictyophara*, and with wing-covers gradually widening toward the almost semicircular apex. Head longer than wide, about one-fourth longer than the pronotum, the surface sunken, with the lateral margins strongly carinate, a keel throughout the middle line, and tip of vertex truncated, the summit of front projecting before the end of vertex; the front is long and narrow, sinuated each side before the eyes, with three prominent carinate lines throughout the length, the two lateral ones gradually approaching below, and the lateral margins strongly reflexed, and so continued to the apex of the clypeus, the clypeus short, carinat on the middle, acutely curving toward the tip; inferior cheeks long, narrow, sunken throughout; antennæ, the second joint large and subglobose, with a collar-like joint at base, an ocellus is situated beneath and near the front curve of eye, frontal ocellus absent; rostrum slender, reaching behind the posterior coxæ. Pronotum short, saddle-like, deeply triangularly emarginated behind, carried forward in an acute triangle between the eyes, carinate on the middle, the side-flaps beneath the carina oblique, longer than wide, ovate, with the narrow end directed anteriorly; dorsolum of the mesonotum longer than wide,

angularly suboval, with the middle line and outer boundaries carinate; scutellum small, triangular, flat. Posterior tibiæ long, prismatic, armed on the outer edge with six stout spines, basal joint of tarsi longer than the second and third united, bordered by a rib which at tip projects back as a spine. Wings long and narrow, gradually widening posteriorly, transverse veins few, confined to the apical division, the basal cell long and narrow, the radial vein uniting with the superior ulnar before reaching the cell, the inferior ulnar more widely separated from the superior than the radial is; the pterostigma much longer than wide, subovate, acute at tip, three or four celled, the middle cell largest, a single cross vein exists on the discoidal area.

ORTHOPAGUS LUNULIFER, new species.

Surface pale clay yellow, or testaceous, marked with brown. Head elongated, the vertex about one-third longer than wide, brown, bordered with pale yellow, sunken, the carinate lines of border and middle high and dark brown, apex with a small knob; front and clypeus pale clay yellowish, with a broad whitish crossing the apex of front base of clypeus and the cheeks, the three carinate lines and outer carinate margins dotted with brown; rostrum pale testaceous, flecked with brown, and with a brown tip. Pronotum unevenly ribbed and grained with brown, the middle carina marked with brown spots, mesonotum with the carinate lines paler than the surface, the scutellum smooth and white. Wing-covers obscurely hyaline, with the pterostigma, a wide sublunate spot which covers the apex inferiorly, and the posterior margin more faintly, brown, a whitish double spot appears on the inner curve of the brown spot, and most of the cross veins are whitish; apex of the wings with a narrow brown arc and brown veins. Legs pale yellow, banded and marked with brown, the tibial spines, spurs, base, and apex of tibiæ and tip of tarsi dark brown. Abdomen flattened, the tergum with large spots, streaks, and margins of segments brown; venter with large and small brown spots. Mesopleura with a broad brown band which connects with that upon the clypeus, numerous brown spots are distributed over the remainder of the pleural and sternal segments.

Length to apex of abdomen: Male, 9; female, 10 mm. Expanse of hemelytra, 24–25 mm.

Type.—No. 3123, U.S.N.M.

The wing-covers of some specimens are somewhat suffused with yellow, and the posterior edge of the wings is dark brown.

Subfamily CIXIIDA.

CIXIUS SUBNUBILUS, new species.

Moderately robust, chestnut brown a little polished, invested posteriorly with the usual white cottony secretion, the under side dark brown, with the metasternum occupied by a large pale spot. Vertex

about one-fourth longer than wide, a very little narrowing anteriorly, deeply grooved, with high lateral margins, dark brown, bordered with pale yellow, the posterior end deeply, triangularly emarginated; front subelliptical, acutely tapering below, dark brown, with a large, oval, testaceous spot below the middle, continued down upon the clypeus, the middle carina very prominent, pale inferiorly, with a short fork at the summit, the surface is deeply scooped out, leaving the margins very prominently carinated; clypeus continuing the lines of the front to a very acute apex; rostrum pale fulvous, piceous at tip, reaching almost to apex of anal segment. Pronotum very short, deeply emarginated, the sides curving, widening exteriorly and bounded by paler carinate lines, the lateral flaps flat, longer than wide, subquadrangular, the surface dark brown, bordered with yellowish; mesonotum trapeziform, acute-angled, dark brown, with five medial carinate lines, of which the middle one is darker than the others, the scutellum acute, pale yellowish, and bordered with a narrow carinate edge. Femora dark brown, pale at base and tip; tibiæ pale brownish, faintly banded with brown near base and tip, tarsi very long, yellowish. Segments of pleura and abdomen slenderly edged with yellowish. Wing-covers milky hyaline, the veins coarse and dark brown, pterostigma large, dark brown, pale at base, inner transverse veins of the apical series mostly marked with a small brown spot, one or two similar spots near the disk, and some brown vestiges around the posterior border and on the edge.

Length to end of abdomen, 7 mm. Length to tip of wing-covers, 12 mm.

Type.—No. 3124, U.S.N.M.

Three specimens are in the collection. The usual cottony secretion is present at the tip of the abdomen.

COTYLECEPS MARMORATA, new species.

A narrow-bodied chestnut-brown form with pale, testaceous, mottled, and granulated wing-covers, and smoke-brown wings, which might be confused with some forms of the Phryganid genus *Hydropsyche;* at rest the wing-covers are held nearly vertical. Head compressed above, dark brown, vertex with almost foliaceous sides, deeply sunken longitudinally, gaping posteriorly, forming a high rounded lobe above the eyes, and is marked with two or three whitish streaks, front deeply grooved, brown, gradually widening and curving toward the clypeus, mottled and streaked with whitish next the border, clypeus narrowing belong in continuity with the lines of the front, terminating in an acute tip, paler below; the rostrum pale yellowish, reaching upon the genital segment. Pronotum almost lamellar, formed of a lobe each side, acutely elevated in the middle and very short there, deeply emarginated, the lateral flaps separated from the dorsal surface by an acute carina, the lateral flaps broad and long, yellow, curving downward, with carinate

margins; mesonotum subequilateral, with the anterior angle produced over the head, with the lateral margins carried back in a small sinus which is followed behind by a larger sinus, the edge carinated, the middle line and a diagonal line each side of it strongly carinated, scutellum triangular, curved upward. Wing-covers very moderately widening toward the apex, a little concave on the posterior margin, clouded with pale brown, the pterostigma orange, dark brown at base and apex, and a smaller orange and brown spot on the opposite (hind) border, a subdeltoid spot on apical border connected behind with other dark-brown patches, and preceded next the costa by a brown arc, basal third of wing-cover with several flexed, pale-brown marks, veins dotted with brown; wings smoke brown, paler at base, veins darker. Abdomen bordered and banded with yellow.

Length to end of abdomen, 5–6 mm. Expanse of wing-covers, 13–16 mm.

Type.—No. 3131, U.S.N.M.

Four specimens of different sizes and varying markings are in the collection.

MYNDUS APICALIS, new species.

Form normal, ground color blackish brown, dull. Vertex moderately narrow, a little wider behind, with yellow carinate margins, and the base acutely emarginated and upturned on the apex of the emargination; eyes large, round, bordered by a carina around the socket; front wide, broadest in the middle, with a carinate middle line which is paler and continued to the apex of the clypeus, the lateral margins fulvous, carinately reflexed; rostrum dull testaceous, piceous at tip, reaching to the posterior coxæ. Pronotum narrow, carried triangularly upon the grooved vertex, the margins fulvous; mesonotum with five fulvous carinate lines, rather close together; the scutellum testaceous, bluntly triangular. Legs fulvo-testaceous, darker at ends of femora and tibiæ. Wing-covers milky-whitish, or yellowish, two specimens dusky at tip, veins brown toward the apex, with dark brown ends to the apical ones, and five cross streaks on the bases of the apical areoles, costal area crossed by a single stout vein; wings with the veins darker at tip, and sometimes with a wide dark suffusion at that point. Legs dusky yellowish, the femora darker. Abdomen brownish black, depressed, covered at tip with cottony white secretion.

Length to tip of abdomen, 4 mm.; width of mesonotum, 1½ mm.; length to tip of wing-covers, 6–7 mm.

Type.—No. 3121, U.S.N.M.

Five specimens are present in the collection.

Subfamily ACHILIDA.

CATONIDIA, new genus.

Form of *Achilus*, Kirby; vertex short, transverse, carinated, curved, but little raised above the level of eyes, carinated on all the borders, the front long wedge-shaped, with a middle carina percurrent to tip

of clypeus, and divided by the transverse suture, the lateral margins strongly reflexed, a little curved, rostrum slender, longer than the face and clypeus together, cheeks deeply sunken throughout, curved, acutely tapering; antennæ second joint subglobose, a little longer than wide, the following joints very slender, setaceous. Pronotum nearly twice as long as the vertex, with the anterior shield lunate, the sides beyond this curving, ending triangularly, and bounded by a thick carina, the lateral flaps small, subtrapezoidal, curved on the lower margin; mesonotum ample, a little wider than long, triangular in front and laterally, the middle shield carinate on the middle and sides, running back triangularly against the narrow and small scutellum, before which it is moderately sinuated. Wing-covers expanded from the tip of clavus to apex of membrane, bluntly rounded, costal area broad, crossed at the apex by a few diagonal and bent veins, and these are continued by an apical series of straighter veins which bound the marginal row of small areoles, the areoles next before these long and narrow, mostly acute at the inner end, the one next the inner border very long, much wider at tip. Legs moderately short, slender, the femora compressed, almost prismatic, carinated, the tibiæ carinate, the posterior ones with a single tooth nearer the tip. Abdomen depressed, the connexivum wide and thin.

CATONIDIA SOBRINA, new species.

Pale fulvo-testaceous, more dusky above. Head short, carinate on the middle line of the vertex, polished, pale testaceous, face minutely scabrous; rostrum reaching to beyond the apex of the posterior coxæ, brown at tip. Pronotum pale, polished, with a carina on the middle; mesonotum almost flat, pale fulvous, convex around the anterior curve, the scutellum scooped out, and with thick carinate margins. Wing-covers dull brownish testaceous, dusky at apex, the veins pale, dotted and flecked with brown, those bounding the apical series pale testaceous, the two principal ones of the clavus thick, dotted with brown; wings dusky, darker at tip, and with dark brown veins. Tibiæ and tarsi a little dusky. Venter darker in the middle, pale on the sutures.

Length to end of abdomen, 7 mm.; width of mesonotum, $3\frac{3}{4}$ mm.; length to tip of wing-covers, 10 mm.

Type.—No. 3118, U.S.N.M.

Only two specimens of this form are in the collection.

Subfamily ISSIDA.

HEMISPHÆRIUS FLAVIMACULA, Walker.

Hemisphærius flavimacula, WALKER, Brit. Mus. List. II, p. 378.

Seven specimens of two or three varieties are in the collection.

Subfamily DERBIDA.

OTIOCERUS FLEXUOSUS, new species.

Somewhat resembling *O. coquebertii*, Kirby, but of smaller size, having the head composed of a foliole of a broad oval form destitute of an angle at the upper extremity, and with the milky-white wing-covers marked with a flexuous red line, which starts beyond the base and extends out to the forward margin of the apex, a large red spot is present on the opposite side of the apex, and a red trace a little way from the base. Head with a red spot along the fore border of the foliole; principal joint of antennæ ligulate; clypeus yellowish white. Legs and abdomen yellowish white. Genital attachments of the male long, slender, curved, the upper one single, broad ligulate, grooved. Ground color of wing-covers and wings milk white.

Length to tip of abdomen, 4 mm.; expanse of wing-covers, 16 mm.

Type.—No. 3120, U.S.N.M.

Only two specimens of this delicate insect are in the collection.

DIOSTROMBUS, new genus.

Somewhat resembling a *Termes* in the form of the wing-covers, but with a short, ovoid body. Head roundish above, including the large eyes, prominent in front, where it is grooved on the middle line, a little wider above, and carinated on each lateral margin; below this, including the clypeus, beak-shaped, flattened on the sides; very long, and continued by a stout rostrum which extends to the posterior coxæ; antennæ, second joint stout, claviform, and completed by a very slender bristle; eyes broadly circular, the vertex emarginated behind. Pronotum moderately short, emarginated in the middle so as to appear bilobed; mesonotum large, tumidly convex, the scutellar portion very broadly curved. Legs slender, the posterior tibiæ stoutest, armed with two stout teeth at the tip. Costal area of the wing-cover contracted for a long space beyond the middle, followed near the tip by two diagonal veins, the postcostal area continuous to near the tip, crossed before the middle by a single vein, and at tip bounded by two small areoles, the basal areole long and widening toward the apex, from which four veins run acutely oblique outward toward the apical one-fourth of the wing-cover, and followed by four others, which complete the series on the apical portion; all but the two short apical veins are connected by single cross-veins; wings very small, narrow. Abdomen contracted near the base, tumidly obese behind this stricture, the apical abdominal segment deeply and broadly sinuated behind, and on each side of this with a large curved lamella, last ventral segment armed each side with a long, curved appendage.

DIOSTROMBUS POLITUS, new species.

Bright rufofulvous, or dull orange, highly polished. Head *Asiliform*, the clypeus pale yellow, carinate on the middle line, long triangular, a little curved; rostrum dusky at tip; eyes black. Notum a little darker than the rest of the body. Anterior and middle tibiæ and tarsi dark brown; spurs of the pale posterior tibiæ dusky at tip, tarsi dark at tip. Wing-covers tinged with pale brown, the veins dark brown, the costal area yellowish; wings bordered posteriorly with brown; postcostal vein stout, blackish brown, especially at tip, where the apical veins are also coarse and dark.

Length to apex of abdomen, 4 mm.; expanse of wing-covers, 19 mm.

Type.—No. 3119, U.S.N.M.

Four specimens are in the collection.

Family MEMBRACIDÆ.

ORTHOBELUS FLAVIPES, new species.

Form similar to *O. haranensis*, Fairmaire, but with the humeral processes shorter, oblique, curved, sharp-edged, and acute at tip. Color black or blue black, closely covered with fine bronze pubescence. Head short, coarsely punctate, uneven, with the lobes of each side of lateral margin reflexed; eyes brown, prominent; clypeus tufted with coarse, long pubescence. Pronotum roughly and coarsely punctate throughout, with the posterior process long, slender, carinate above and on the edges and acute at the tip, the depression back of the humeri sometimes with a small white spot, middle line carinated throughout. Wing-covers yellowish hyaline, the small coriaceous base very thick, black, coarsely punctate, veins pale brown from base outward, but dark brown toward the tip, areoles of the apical series growing narrower toward the postcostal border. Sides of pro and meso pleura with large white patches. Legs black, tibiæ, apex of femora, and all but tip of tarsi yellowish, bristly. Veins of wing-covers punctate and set with bronze bristles.

Length to tip of thoracic process, 4–4½ mm.; to tip of wing-covers, 6 mm.

Type.—No. 3142, U.S.N.M.

Seven specimens of this interesting form are in the collection.

MACHÆROTYPUS SELLATUS, new species.

Dull brown, bronze pubescent, resembling *Campylocentrus curvidens*, Fairmaire, but with shorter and more auriculate, blunter, excavated humeral expansions. Head short, bluntly rounded, closely punctate, and densely covered with long pubescence. Pronotum a little compressed anteriorly, closely punctate and pubescent, with two small black callosities each side, a transverse raised belt just behind the

sulcus, indented on the middle and carinated on the outer margins, middle line carinated throughout to the very tip of the wedge-shaped process, which extends as far as the apical series of areoles of the wing-covers, is a little curved down and very acute at tip, the lateral margin deeply sinuated before the base of the humeral auricles, the auricles triangular above, the outer angles subtriangular. Wing-covers broad, triangular at tip, the coriaceous base very small, coarsely punctate, blackish. Legs pale brownish, the femora and tip of tarsi darker.

Length to tip of thoracic process, 4 mm.; to tip of wing-covers, 5–5½ mm.

Type.—No. 3141, U.S.N.M.

Seven specimens of almost uniform appearance are in the collection.

Family CERCOPIDÆ.

MONECPHORA ASSIMILIS, new species.

Body moderately narrow, dark brown or black when mature, the wing-covers carried steeper than usual. Head, as seen from above, shorter than wide, the vertex coarsely effaced-punctate, scabrous, greenish black, longitudinally impressed each side of middle, the intervening surface with large tumid elevations, and the apex recurved; face moderately prominent, a little rough, broadly grooved, with the carinate borders spreading apart below; rostrum yellowish, extending behind the middle coxæ. Pronotum transverse, convex, rugulose and coarsely, closely punctate behind the impressed anterior lobe. Wing-covers moderately narrow, densely punctate and scabrous, finely pubescent, obliquely rounded at tip. Metasternum, pleural pieces, and coxæ yellowish; legs black or piceous, the middle and posterior tibiæ sometimes pale.

Length to tip of wing-covers, 6½–8 mm.; width of pronotum, 2½ mm.

Type.—No. 3139, U.S.N.M.

Fourteen specimens of three degrees of maturity are in the collection. The females are usually larger than the males and less firm in texture of wing-covers.

Subfamily APHROPHORINÆ.

PHILÆNUS SPUMARIUS, Linnæus.

Cercopis spumaria, LINNÆUS, Syst. Nat., 12 ed., p. 708.

Twenty-nine specimens of two or three varieties of this species are present in the collection.

LEPYRONIA GROSSA, new species.

This is a larger, more robust, and inflated form than *L. coleoptrata*, Linnæus. The pattern of marking of the female is much like that of the species cited, but it is nearly twice as large. Surface dull, grayish clay drab, black beneath and on the tergum. Vertex usually blackish

in the males, grayish drab in the females, wider than long, angularly curbed, with the tip callous and a little recurved, pale, followed behind by a broad impression, the surface generally uneven, closely covered with grayish pubescence; eyes oblique, continuing the curve of the lateral margin, brown; front tumidly convex, mostly black, coarsely ribbed, longer than wide, separated from the spindle-shaped clypeus by a constricted interval; rostrum black, pale in the middle, reaching to the middle coxæ. Pronotum uneven, wider than long, closely pubescent, triangularly emarginate posteriorly, callosities wide apart, transverse, suboval, indented in the middle, the surface unevenly granulated and with some obsolete punctures, lateral margins a little oblique, middle line sulcated. Scutellum faintly each side of the middle, minutely shagreened and punctate, with the sides feebly sinuated, the middle with a short prominent, thick ridge, tip acute and pale. Wing-covers much inflated, as usual longer than the body, the inner margin of apex oblique, the outer oblique and a little curved, the base uneven, with two or three impressed spaces on and interior to the costal area, one of these runs from costa diagonally inward, base with a large triangular black spot, which starts at the scutellum and runs back obliquely outward to behind the middle of the costa, from this a broad band runs obliquely inward behind the apex of the clavus; inner corner of corium with a black spot, which is sometimes forked; pale portion of disk dotted with black in the female; surface generally pubescent. Legs piceous or black, the posterior tibiæ bounded with pale. Mesosternum with a pale spot.

Length to apex of wing-covers, 7–9 mm.; width of pronotum, 3–3¼ mm.

Type.—No. 3133, U.S.N.M.

Twenty-six specimens of this fine species are present in this collection. The black markings on the wing-covers of the male are more sharply defined and concentrated than in the female. The male is also relatively rounder and broader than the female.

PHILAGRA ALBINOTATA, new species.

Robust, subovate, obscure dark brown, marked with a costal longitudinal pale, angular spot, or with a rhomboidal spot near the costal apex and two or more pale spots on the disk of the wing-covers. Head produced, recurved toward the tip, forming a cylindrical tapering horn, with a polished callous tip, shagreened and somewhat punctate on the middle and basal part of vertex; face polished, having a broad yellow vittata which, originating near the tip, forks to follow the margin back to base and then continues upon the pleura to posterior coxæ; rostrum stout, piceous, reaching to middle coxæ. Pronotum a little wider than long, scabrous, a little coarsely punctate in front, pubescent, with a yellow spot each side next the callosities, posterior margin deeply, triangularly emarginated, with a slender carinate line on the middle which continues on the head; scutellum with an ivory-yellow spot at

tip. Wing-covers of moderate width, strongly arcuated on the costal border, nearly straight on the opposite margin to near the tip, the tip obliquely curved, the surface minutely scabrous, finely pubescent, with a series of about four, approximate, oblong, small pale spots on the disk, and a larger one near the apex of costa, the costal margin strongly reflexed. Sternum and venter banded with white. Legs pale chestnut brown, the middle and posterior coxæ and adjoining pleural pieces whitish yellow.

Length to end of wing-covers, 11½–12½ mm.; width of pronotum, 2¾–3 mm.; length of horn of head, 2½ mm.

Type.—No. 3138, U.S.N.M.

Eleven specimens of this singular insect are in the collection.

APHROPHORA MAJOR, new species.

Form similar to that of *A. alni*, Fallen; pale brownish testaceous, with a tinge of gray, minutely pubescent, densely and roughly punctate. Vertex about half as long as wide, lunately arcuated, and oblique at the very tip, middle line carinated on a longitudinal ridge, which is darker than the adjoining surface, apical margin callous and pale; front low, longer than wide, moderately convex, curving narrower inferiorly, crossed by sharp-cut, yellowish ribs, which are separated by black, punctate grooves, the middle line callous, and pale above, clypeus with a central dagger-shaped white callosity, which connects above with the callous, white transverse border of the apex of front; cheeks tawny, unevenly punctate; rostrum piceous toward the tip, reaching to the posterior coxæ. Pronotum very feebly convex, longer than wide, punctate with brown in uneven, transverse rough grooves, the lateral margins obliquely narrowing posteriorly, the middle of apical margin slightly acute, posterior margin triangularly emarginated, the middle line interruptedly carinated; scutellum abruptly tapering from middle to tip, punctate with brown at base, pale yellowish and smooth near the tip. Wing covers gradually tapering to an almost acute tip, closely and a little more coarsely punctate toward the base, the inner margin quite straight until next the slightly expanded tip, the costal margin gently curved, veins long, forming long narrow areoles, cells of the apex short and narrow, the discoidal middle vein marked on the center with a pale round spot. Margins of the meso and meta pleura and sternum whitish testaceous. Legs pale tawny, tinged with darker, the apex of all the tarsi piceous. Venter polished, pale tawny.

Length to end of abdomen, 7–11 mm.; to tip of wing-covers, 10–13½ mm.; width of pronotum, — mm.

Type.—No. 3134, U.S.N.M.

Twenty specimens of this variable species were placed in the collection. The range of variation in the size of the individuals is something most remarkable. In some specimens also the apex of the head is acute and almost triangular.

APHROPHORA OBLIQUA, new species.

Pale fulvo-testaceous, coated with grayish pubescence, form of *A. alni*, Fallen. Vertex short, lunate, with the apex a little triangular and recurved, the adjoining margin pale and smooth, a transverse groove crosses the line of the ocelli, and a depression exists behind the ocelli, surface uneven punctate, depressed area curving inward from the eye pale; front moderately convex, acute at the summit of the fusiform callous middle line, which is smooth and pale yellow, and with a black suture each side above, transverse ribs coarse, yellowish, with the intervening sutures blackish, punctate, and having the depression at the apex closely punctate with black; clypeus with a triangular callosity at base, which is followed below by a dagger-shaped, also pale, callosity, bounded each side by lines of punctures; cheeks uneven, punctate; rostrum yellowish, reaching behind the posterior coxæ, black at tip. Pronotum a little longer than wide, obcure orange anteriorly, dark brownish behind and on the scutellum, coarsely punctate in wavy lines posteriorly, less closely so anteriorly, middle line roughly carinated, posterior margin triangularly sinuated, the lateral margins oblique, anterior margin acute in the middle; scutellum acutely tapering to tip, with the lateral margins yellowish. Wing-covers pale grayish, the base fuscous, disk fuscous, mottled with pale testaceous, covered with fine pubescence, a broad, broken, pale diagonal band extends from the inner angle of the clavus to before the middle of the costa, inner end bending back upon the clavus, surface rough and punctate, the apical one-third pale, with a brown spot at tip. Legs testaceous, with the apex of tibiæ and bands on joints of tarsi brown. Abdominal segments bordered with whitish. Spots on sides of mesopleura and posterior part of metapleura whitish.

Length to tip of wing-covers, 8–8½ mm.; width of pronotum, 2¾ mm.

Type.—No. 3135, U.S.N.M.

Thirteen specimens are present in the collection.

APHROPHORA INTERMEDIA, new species.

Somewhat broader than the preceding species, but similarly marked and more than twice as large. Color pale brown, finely grayish pubescent, densely and rather finely punctate on the upper surface and wing-covers. Head dull tawny brown above, black beneath, the vertex short, uneven, anterior margin a little curved, almost triangular, with the reflexed margin callous and pale, middle depressed, unevenly, somewhat remotely, punctate, eyes dark brown, not prominent; front rather short, blunt subconical, convex, coarsely ribbed, the sutures coarsely punctate, above the base of clypeus callous, yellow; cheeks uneven, rough, punctate in places, hirsute, bordered with yellow; antennæ honey yellow; rostrum black at base and tip, yellow in the middle, reaching upon the posterior coxæ. Sternal and pleural

pieces bordered and marked with yellow. Coxæ piceous, the posterior pair and metasternum yellowish testaceous; anterior and middle femora testaceous, twice banded with black, the posterior femora piceous, with the tibiæ piceous and banded with yellow, apex of tarsi piceous. Wing-covers with a fuscous cloud at base, omitting the clavus, on the middle a large subtriangular band, the two dark areas separated by an oblique, white band, apex almost hyaline, marked next the inner extremity by a long, dusky spot, the two extreme apical areoles much longer than the others, the series of small ones next beyond the costal area separated by oblique veins; wings dark brown. Abdomen dull black, the sutures very slenderly pale, and the connexivum bordered with pale yellow.

Length to tip of wing covers, 11–12 mm.; width of pronotum, $3\frac{1}{2}$–4 mm.

Type.—No. 3136, U.S.N.M.

Ten specimens are in the collection. They vary somewhat in depth of color, but otherwise seem to be unusually uniform in appearance.

APHROPHORA FLAVIPES, new species.

Narrower than either of the foregoing species, pale fulvo-testaceous, roughly punctate on most of the upper surface. Vertex yellow, with a broad, brown stripe on the middle, longer than in either of the preceding species, the anterior margin acute, with the tip a little produced, roundedly triangular, slightly reflexed, obsoletely carinated on the middle, the surface sunken at the position of the ocelli; eyes oblique, very moderately prominent; front much longer than wide, nearly ovate, high, very convex, middle callous line yellow, very slender, with the sutures each side closely punctate with brown, transverse ribs fine, tawny, with the sutures dark, slender, punctate; rostrum reaching behind the posterior coxæ, broadly piceous at tip. Pronotum longer than wide, latero-posterior margins obliquely narrowing posteriorly, sinuated at base to fit the wing-cover, a broad, black stripe on the middle anteriorly, covering the acuminate point of the margin, each side of this is orange-colored spot, posterior half of surface dusky, and thickly punctate, middle line interruptedly carinate, the posterior margin triangularly and deeply emarginate, the lateral margins broadly reflexed. Scutellum pale orange, finely punctate, fuscous on the middle, slenderly tapering behind the middle, making a narrow tip. Wing-covers pale brownish testaceous, with an irregular brown spot next costal margin crossing near the base, another, larger, across the disk, and a third, smaller one, next the middle of the anteapical series of areoles, a series of four or five diagonal cross-veins on the postcostal apex, one of the second series of brown spots is placed upon the middle of clavus. Breast and legs mostly yellow, apex of the tarsi piceous. Venter fulvous, tinged with yellow.

Length to end of wing-covers, 9–10½ mm.; width of pronotum, 2¾–3¼ mm.

Type.—No. 3137, U.S.N.M.

Twelve specimens of this species are in the collection.

APHROPHORA INDENTATA, new species.

Testaceous, with a pale grayish-brown tinge, polished, roughly, but closely and finely punctate, in form similar to *A. quadrinotata*, Say, but rather broader, and different in details. Vertex short, subtriangular, with the apex prominent, the margin raised, thick and callous, pale, middle carina very prominent, the surface each side of it much depressed, with dark patches in the hollows, and on two spots on the anterior margin, front very prominent, convex, but little longer than wide, with an ivory-white spot above, the middle line punctate with black each side, transverse sulci blackish, the upper ones more distinctly punctate, the apex and clypeus testaceous; rostrum soiled testaceous, reaching upon the posterior coxæ, piceous at tip. Pronotum scarcely longer than wide, very convex, carinated on the middle line, acute at forward end of the carina, latero-posterior margins oblique, the lateral margins short, nearly straight, feebly carinate; surface coarsely punctate, marked with irregular brown spots or clouds; scutellum pale, indented, brown, and punctate in the middle, slender, short, acute, and pale at tip. Wing-covers whitish-testaceous, tumidly inflated on the middle back of the costal area, unevenly marbled with brown, leaving interruptions on some of the veins, usually with a brown spot on the middle of the anteapical series, a smaller one near the apex, costally, and three small streaks at the end of three apical, superior, veins, postcostal space marked with only one small areole. Legs soiled testaceous, the femora clouded with a brown spot, and two faint, dusky bands on the tibiæ, tarsal nails piceous. Sternum and pleura pale testaceous. Venter orange fulvous, smooth, sutures of the segments narrowly bordered with rufous.

Length to tip of hemelytra, 7–8 mm.; width of pronotum, 2½ mm.

Type.—No. 3132, U.S.N.M.

Eight specimens, all more or less different, are in the collection.

Family JASSIDÆ.

PETALOCEPHALA DISCOLOR, new species.

Long and narrow, rusty brown with a tinge of orange. Head a little longer than the prothorax, triangularly rounded at the apex, the extreme tip recurved; surface dull, densely, minutely scabrous, obsoletely pubescent, almost flat, the antero-lateral margin reflexed, the middle line bluntly elevated; eyes dark brown, but little raised above the margin; ocelli seated against a slight depression; face broadly scooped out, black, with a yellow fusiform stripe on the middle, clypeus and

rostrum yellow; antennæ yellow, the bristle brown, the basal three joints moniliform. Pronotum convex on the dorsal portion, unevenly rugulose and punctate, marbled or clouded with fuscous, depressed anteriorly to the level of the head, anterior margin pale, a little curved, shorter than the posterior one, the posterior margin broadly bilobate, the lobes separated by a deep and wide sinus, widely testaceous, the humeri bluntly triangular; mesonotum small, transverse, indented each side of base of scutellum and with three pale callosities at that point; scutellum very small, triangular, pointed with brown like the rest of the notum. Wing-covers almost parallel-sided, widening at the base of the membrane, and obliquely curving from thence to apex, color dull pale hyaline, streaked and bordered with brown areas, irregularly punctate and rugulose, the clavus opaque, thick, dark brown, the inner border interrupted with whitish, veins pale brown, partly interrupted with whitish, veins of the apical cells next the costal border short, broken, a little sinuous, dark brown. Legs pale dull brown, darker at the ends of the members and tips of tarsi. The under side black, and the segments all edged with whitish.

Length to end of abdomen, 7–9 mm.; to tip of wing-covers, $9\frac{1}{2}$–$11\frac{1}{2}$ mm.; width of base of pronotum, $2\frac{1}{2}$–3 mm.

Type.—No. 3143, U.S.N.M.

Four specimens, varying in colors and marking, are in the collection.

LEDRA AUDITURA, Walker.

Ledra auditura, WALKER, Brit. Mus. List, Supp., p. 249.

Nine specimens, some of which are very large females, are present in this collection. They vary considerably in colors and patterns of marking.

PENTHIMIA ATRA, Fabricius.

Penthimia atra, FABRICIUS, Ent. Syst., IV, p. 55, No. 36.

Four specimens of large size and black color are in this collection. One individual has a pale band across the pronotum.

PARABOLOCRATUS GUTTATUS, new species.

Elongated, bright pea green, polished. Head almost as long as wide, triangularly rounded in front, the subacute apex a little upturned, eyes brown, long, bluntly triangular on the inner side, the depressed middle crossed by two impressed lines, and a very slender impressed line on the middle; antennæ very long and slender, yellow from base to middle, brown from thence to tip. Pronotum short, sublunate, with the lateral ends diagonal and moderately rounded, the surface very finely wrinkled. Sternum and legs paler, the femora with some black specks, the tibiæ dotted with black, and with black spines. Wing-covers wedge-shaped when closed, a little tinged with yellow above, the margin of the clavus marked with two black, small spots,

one of which is on the apex, apical ends of membrane with two or three black traces, the surface highly polished.

Length to tip of wing-covers, 6–7 mm.; width of pronotum, 2 mm.

Type.—No. 3140, U.S.N.M.

Ten specimens are in the collection.

SELENOCEPHALUS VITTATIPES, new species.

Pale straw color; head broad, vertex sublunate, subtriangular and a little recurved at tip, the surface transversely depressed and slightly discolored; eyes large, ovate, brown; front broad and short, fuscous below, and crossed by close-set, fine brown lines. Pronotum broad, the transverse tabulate anterior lobe callous, the surface back of this crossed by fine, close wrinkles. Scutellum smooth, triangular, wider than long, acute at tip. Testaceo-hyaline, with yellowish veins. Legs dull straw yellow, with a black stripe on the posterior side of the femora and tibiæ.

Length to tip of wing-covers, 7 mm.; width of pronotum, 2½ mm.

Type.—No. 3127, U.S.N.M.

Only one specimen, a female, is in the collection.

SELENOCEPHALUS CINCTICEPS, new species.

Pale green, slender, with a slight black band behind the tip of vertex. Head short, sublunate, scarcely wider than the pronotum, the vertex feebly angular on the pale, recurved tip, this part separated behind by a transverse, impressed line which is usually colored black, the middle line behind this very slender, black, front long, gradually curving narrower below, banded with slender black lines, clypeus, rostrum, and cheeks ivory yellow. Eyes brown. Pronotum short, green, with the front border and oblique sides yellowish, a little uneven and indented anteriorly, the posterior submargin including the sides linearly impressed and the edge reflexed; scutellum yellowish, triangular, depressed across the middle, acute at tip. Legs yellowish, with the spines and tips of tarsi brown. Under side ivory white. Wing-covers highly polished, long and narrow, yellow posteriorly and almost white along the costal border.

Length to tip of wing-covers, 5–6 mm.; width of pronotum, 1¼–1½ mm.

Type.—No. 3128, U.S.N.M.

Fifteen specimens, including two or three varieties, are in the collection. Some of the males have a wide black spot across the end of the wing-covers.

PACHYOPSIS MUNDUS, new species.

Pale greenish yellow, almost opaque, front and vertex almost coalescing, convex, the vertex short. Pronotum as wide as the head with the eyes, much wider than long, narrowly wrinkled, with the sides rounded, and the disk moderately convex, having an impressed, transverse,

curved line anteriorly. Scutellum with a roundish fossa each side of base. Wing-covers very coarsely and obsoletely, remotely punctate. Legs pale yellowish.

Length to tip of wing-covers, 6 mm.; width of pronotum, 2 mm.

Type.—No. 3126, U.S.N.M.

Only two specimens are in the collection. Not so stout as *P. robustus, Uhler.*

EUACANTHUS INTERRUPTUS, Linnæus.

Euacanthus interruptus, LINNÆUS, Fauna Suec., p. 889

Six specimens of two varieties are present.

EUACANTHUS ANGUSTATUS, new species.

Much narrower and longer than the preceding species, and with fully developed wing-covers. The head is also less indented and slightly narrower. Color black; head with a large yellow, angular spot next the eye and extending behind connects with the same color on the cheeks, each side of middle behind is round fossa, followed exteriorly by a shallow groove; face yellow, with three black spots above, surmounted by a yellow dot in the black of the vertex, and on the middle a black dot. Pronotum sublunate, polished, partly bordered each side before by a yellow band. Scutellum with a yellow subtriangular spot at base, and the acute tip also yellow. Wing-covers long and narrow, black, polished, bordered with pale yellow. Middle of sternum with a black spot. Venter narrowly yellow on the sutures of the segments.

Length to tip of hemelytra, 6½–7 mm.; width of pronotum, 1½ mm.

Type.—No. 3129, U.S.N.M.

Eight specimens are present. Possibly this is the macropterous form of the preceding, but it offers a few structural points of difference therefrom.

TETTIGONIA VIRIDIS, Linnæus.

Tettigonia viridis, LINNÆUS, Fauna Suec., p. 896.

Thirteen specimens of the common form are present in the collection, although some are of large size.

TETTIGONIA FERRUGINEA, Fabricius.

Tettigonia ferruginea, FABRICIUS, Entom. Syst., p. 32, No. 22.—SIGNORET, Ann. Soc. Ent. France, 1863, p. 676, pl. XXII, fig. 5.

Fifteen specimens, almost exactly alike, contribute a showy element to the collection. The name given to this species by Fabricius is unfortunate, since the insect, instead of being ferruginous, is usually of a bright orange yellow, with black markings.

TETTIGONIA GUTTIGERA, new species.

Form similar to *T. nigroguttata*, Signoret, but with a shorter head and wider pronotum. Color orange or pale yellow, with the surface polished. Vertex much wider than long, bluntly triangular and tumid on the apical division, and which is bounded behind by a wide transverse impression, before the middle three black dots, basal division incised on the middle, and with the posterior margin carinated; front nearly conical, convex, distinctly cross-ribbed, on the middle above is a black dot, the two lateral spots of the vertex sometimes overlapping on the front; clypeus prominently ridged; the rostrum very slender, reaching to the middle coxæ; superior cheeks with a wide, deep longitudinal groove. Pronotum transverse, wider than the head, anteriorly lower than the head, finely wrinkled, coarsely and obsoletely punctate, the sides curving down, and the posterior margin curving forward, middle of posterior margin triangularly emarginate; mesonotum triangular, depressed, obsoletely punctate, the scutellar portion elevated. Wing-covers translucent, thin, the veins and cells long and mostly parallel-sided, unevenly rugulose, broadly curved at tip. Legs and beneath pale yellow, the spines a little darker, and the tip of tarsi piceous.

Length to tip of wing-covers, 10 mm.; width of base of pronotum, 2¼ mm.

Type.—No. 3125, U.S.N.M.

Five specimens are in the collection, of which one is much paler than the others.

THAMNOTETTIX SELLATA, new species.

Broad spindle-shaped, testaceous with a faint bluish tinge, dotted and speckled with pale brown, and with a large, brownish spot on the middle of the wing-covers conjointly, the tip and two or three traces darker brown. Vertex ivory-yellowish, sublunate, slightly triangular, at tip, with a row of fine points near the anterior margin and more remote dots on the posterior margin; front conically narrowing below; eyes brown. Pronotum transverse, highly polished, crossed by a few fine, scratched lines, color ivory-yellow, lateral angles acutely narrowing, the postero-lateral margin oblique. Mesodorsum, including the scutellum, triangular and a little shorter than wide, with two small brown dots near base, separated by a slender line, and followed on the scutellum by a brown, transverse spot, scutellum bounded at base by a curved suture. Wing-covers curved, wedge-shaped by contact at the apical area, finely dotted, sprinkled and veined with brown, the ovate, central spot partly margined with darker brown, effaced on the sutural line, apex of membrane with a suffused brown spot which has a few pale dots inclosed in it, the superior apical angle rectangular, costal border curved, pale, the subcostal vein speckled with brown. Legs

spotted and dotted with brown, the tibiæ with a brown dot at base of many of the spines, tarsal joints interrupted with brown.

Length to tip of wing-covers, 4½ mm.; width of pronotum, 1¼ mm.

Type.—No. 3130, U.S.N.M.

Only two specimens of this modest little species are in the collection. It somewhat resembles *Jassus seminudus*, Say, in pattern of marking and colors, but it is a much wider insect, more wedge-shaped posteriorly, and with a more acute vertex.

LIMOTETTIX?, species.

Twelve specimens of a long and narrow species related to *Deltocephalus* are present in one of the boxes. This insect has so much resemblance to the European insects of this type that I hesitate to describe it, believing that it must have been published heretofore by some of the German or Scandinavian entomologists.

The Psyllidæ of the collection have been worked up by Mr. E. A. Schwarz, and his descriptions are herewith appended.

ANOMONEURA, Schwarz, new genus.

Head strongly inclined: plates of vertex anteriorly obliquely truncate and subtriangularly produced near the anterior ocellus; frontal processes cone-shaped, depressed below the level of the vertex; eyes large globular; anterior ocellus visible from above; antennæ long and slender; third joint much longer and thinner than the second. Pronotum strongly ascending posteriorly, lateral impressions distinct; dorsulum transverse, slightly ascending posteriorly. Fore wings elongate, membraneous, of equal width from middle to apical fourth, apical edge rounded but not regularly so, the tip of the wing being much nearer to the anterior than to the posterior costa; petiolus cubiti about half the length of the discoidal part of subcosta; a long pterostigma; radius slightly curved and normal at its basal half, beyond the middle giving forth two (sometimes three, or even four) parallel cross veins which run obliquely through the radial cell to the outer costa; at apical fourth the radius bifurcates, thus forming a large marginal cell, which is crossed by the fourth furcal vein; stem of second fork greatly arched at basal half; discoidal cell closed, first marginal cell much smaller than the second; fourth furcal vein running in the tip of the wing; hind tibiæ not toothed at base; genital plate and forceps of male without appendages.

Belongs to the tribe Psyllini and agrees with the genus *Psylla* (as defined by Fr. Loew) in shape of the body and in formation of cephalic parts, but differs in the form of the fore wings, and more especially in the venation. The latter is altogether most unusual, and would have been considered as an accidental abnormity if a single specimen only had been examined. The number of accessorial veins connecting the

radius with the outer costa varies from two to four; if there are only two or three, one or the other of them occasionally bifurcates, the bifurcation beginning either near the base or in the middle of the vein.

ANOMONEURA MORI, Schwarz, new species.

Body rather stout, opaque, very finely aciculate, pale yellowish green, or greenish yellow, or pale ocherous, dorsulum and mesonotum with faint markings of a more decided yellow color. Posterior margin of head strongly emarginate, vertex nearly flat, along the median line slightly shorter than half its width at base, nearly parallel between the eyes, anteriorly obliquatus truncate and slightly triangularly produced; discal impressions small but continued anteriorly in an oblique line; frontal processes hairy, as long as the vertex at middle, obtusely triangular, contiguous and broad at base, divergent apically. Antennæ longer than head and thorax combined, filiform, pale yellow, joint 3 slightly longer than 4, joints 4 to 8 subequal in length, tipped with black, joints 9 and 10 entirely black.

Pronotum at middle slightly longer than at the sides, as long as the vertex, anterior edge strongly convex, posterior edge slightly concave; dorsulum at middle nearly twice shorter than its width and decidedly longer than the vertex, anteriorly much more arched than posteriorly.

Fore wings about two and one-half times longer than wide, widest part at apical third, slightly whitish but transparent, with a series of brownish spots on the costa from the outer corner of the clavus to the first branch of the radius; also with numerous small brown dots along the furcal veins and the branches of the radius. Veins moderately fine, pale ocherous, anterior costa nearly straight to within a short distance from the tip, posterior costa beginning to arch at apical fourth; the tip of the wing is therefore not in the middle of the apex, but much nearer the anterior costa than to the posterior costa; discoidal part of subcosta slightly shorter than the basal part, stigma tolerably long, but narrow and not closed; radius as described in the generic description; stem of first (inner) fork longer than the basal part of subcosta, first furcal vein very short, forming an obtuse angle with the stem; second furcal forming an obtuse angle with the stem, abruptly bent beyond its middle and terminating rectangularly on the costa; stem of second fork greatly arching at basal half, straight and parallel with the first stem at terminal half, third furcal vein forming the straight continuation of the stem, fourth furcal continued across the outermost branch of the radius, decidedly longer than the third furcal and terminating in the tip of the wing. Metacoxal processes rather blunt at tip; legs pale greenish or yellowish; tarsi darker.

Male.—Genital plate slightly longer than the genital segment, without lateral lobes, straight, rather broad, about four times higher than wide, hardly narrowing apically; forceps, when viewed from the side, slightly narrower and about one-fifth shorter than the plate, simple,

pointed at tip, front edge slightly convex, hind edge straight; when viewed from behind, the two lobes of the forceps are separated by a narrow slit, the sides of which are not arcuate, but converge gradually toward the tip.

Female.—Genital segment a little longer than the two preceding ventral segments combined; valves normal and gradually narrowing toward the tips, which are moderately acute; upper edge of upper valve (when viewed from the side) slightly concave, lower valve shorter than the upper, and with its lower edge convex.

Type.—No. 3410, U.S.N.M.

The collection contains three female specimens, No. 1154 marked 2367. I have also seen four other specimens (two males, two females) collected in Japan by Mr. Albert Koebele, who writes that this species is very injurious to mulberry and a serious drawback to sericulture.

PSYLLA PYRISUGA Fœrster.

The collection contains eight specimens, No. 1150, which in no way differ from European specimens. The synonymy of this species is given by Dr. Franz Löw.[1]

[1] Ver. K. K. Zool.-Bot. Ges. Wein, XXXII, p. 427 (1882).

ON THE GENUS REMONDIA, GABB, A GROUP OF CRETACEOUS BIVALVE MOLLUSKS.

By TIMOTHY W. STANTON,
Custodian of Mesozoic Invertebrates.

IN 1869 W. M. Gabb[1] described a small collection of Cretaceous fossils obtained by Auguste Rémond de Corbineau near Arivechi, in the State of Sonora, Mexico. The horizon is now known to be about the same as that of the Comanche Peak limestone, which is near the middle of the Texan Comanche series. Among these fossils were several specimens of a peculiar shell for which Gabb proposed the generic name *Remondia*, with the following description:

"Shell compressed, elongate subquadrate, closed at the extremities (or perhaps slightly gaping posteriorly). Ligament very short, external. Hinge composed of three radiating cardinal teeth in each valve, and a long posterior tooth in the left with a corresponding tooth in the right. The middle cardinal tooth of the left valve is transversely striated as in *Trigonia*, and is slightly grooved on its face; the anterior is linear and smooth, and the posterior is also smooth, at least on its posterior face. The posterior lateral and its corresponding cavity are irregularly rugose. In the right valve the anterior tooth is as large as the middle; the posterior is linear; further details unknown.

"This genus is evidently closely allied to *Trigonia*, its quadrate form not being unlike many of the species of that genus, and the transversely striate teeth showing a marked resemblance."

Type.—Remondia fureata, Gabb.

The genus has been recognized in the manuals of conchology and paleontology and placed in the Trigoniidæ by Tryon, Zittel, and Fischer, though the latter remarks that it would perhaps be better placed near *Astarte*. Stoliczka referred to it *Astarte bronnii*, Krauss, from the Lower Cretaceous of South Africa, and recently Cragin[2] has described a species, *Remondia ferrissi*, from the Lower Cretaceous of southern Kansas.

[1] Paleontology of California, II, pp. 257–276.

[2] Amer. Geol., XIV, July, 1894, p. 5, pl. 1, fig. 1; Bull. Washburn College Lab. Nat. Hist., II, No. 10, p. 68.

In 1887 Dr. C. A. White[1] described the genus *Stearnsia* and referred it to the Crassatellidæ, the type being *Stearnsia robbinsi*, from the Comanche series near Fort Worth, Texas. As it differed greatly from *Remondia furcata* in outline and showed no relationship with *Trigonia* no comparisons with Gabb's genus were suggested.

When examining the types of *Remondia* in the Academy of Natural Sciences, Philadelphia, a short time ago, my attention was attracted to their striking resemblance to *Stearnsia* in surface sculpture, form of lunule and escutcheon, and other external characters. Through the courtesy of the Curators of the Academy I have been permitted to study these types more closely and to make direct comparisons with the types of *Stearnsia* in the United States National Museum.

The study of the specimens has shown some errors in the original description of *Remondia*, especially in the details of the hinge, that have prevented the genus from being understood.

The cardinal teeth were clearly seen by Gabb in only one fragmentary specimen, which he described and figured as a left valve, but which is really a right valve, as the lines of growth and position of the ligament show. It has three cardinal teeth as described, but the hinge of the left valve when cleaned shows only two cardinals, thus agreeing with *Stearnsia*. The striation of the cardinal teeth, which seems to have been the principal reason for referring the genus to the Trigoniidæ, is precisely like that seen in many species of *Crassatella* and *Astarte—Crassatella radiosa*, Morton, for example. There is a long slightly rugose posterior lateral lamina or tooth in the left valve and a similar anterior one in the right valve, with corresponding sockets opposite them. This also agrees essentially with *Stearnsia*, though in the original description of that genus the structure here designated as a socket is regarded as two lateral teeth. The character of the lateral laminæ is precisely like that seen in some species of *Crassatella*, such as *Crassatella undulata*, Say, from the Miocene, excepting that their positions are reversed, the right valve of the *Crassatella* bearing the posterior lamina and the left valve the anterior one.

The ligament, instead of being external as described, was partly internal, and a linear lamina traversing the area of attachment indicates that it was separated into ligament proper and resilium.

With these emendations of Gabb's description it is evident that *Remondia* has all the essential features of the Crassatellidæ, or Crassatellitidæ, as the family is now called.[2] The cardinal formula is the same ($\frac{L\ 1010}{R\ 1010}$), and it differs from *Crassatella* (*Crassatellites*) only in the more equal development of the cardinal teeth, the partially external position of the ligament, and the arrangement of the lateral laminæ.

Stearnsia is regarded as a synonym of *Remondia*. The two species on

[1] Proc. Acad. Nat. Sci. Phila., 1887, p. 32.

[2] W. H. Dall, Tertiary Mollusks of Florida, Pt. II, Trans. Wagner Free Inst. of Sci., III, p. 539.

which the genera were based agree in hinge structure, in character of sculpture, especially in early stages of growth, in form of the lunule and escutcheon, and in the presence of an umbonal ridge with an accompanying furrow which produces an emargination of the posterior end. Their chief differences are the external form—subtriangular in the one and elongate subquadrate in the other—and the fact that in *Stearnsia robbinsi* the free margins of the valves are smooth, while in *Remondia furcata* they are crenulate within, but in both these respects there is an equal amount of variation in the genus *Crassatella*.

The genus may be redefined as follows:

Family CRASSATELLITIDÆ.

Genus REMONDIA, Gabb.

(Plate XXVI, figs. 1-8.)

Shell rather compressed, equivalve or nearly so, elongate subquadrate to subtriangular in outline; lunule and escutcheon well marked and deeply excavated; ligament partly internal; hinge with three cardinal teeth and an anterior lateral lamina in the right valve and two cardinals with a posterior lateral lamina in the left; free margins smooth or crenulate within; sculpture consisting of strong concentric ridges and furrows which may become obsolete in later stages of growth; posterior end usually (always?) emarginate.

Type.—*Remondia furcata*, Gabb. Other examples: *Remondia ferrissi*, Cragin, *Stearnsia robbinsi*, White, and possibly *Astarte bronnii*, Krauss,[1] *Astarte sinuata*, d'Orbigny, and *A. carinata*, d'Orbigny.

Note.—The specimens of *Remondia robbinsi* figured are No. 20137, United States National Museum Catalogue of Invertebrate Fossils. Those of *R. furcata* are in the collection of the Academy of Natural Sciences of Philadelphia.

EXPLANATION OF PLATE.

PLATE XXVI.

Remondia furcata, Gabb.

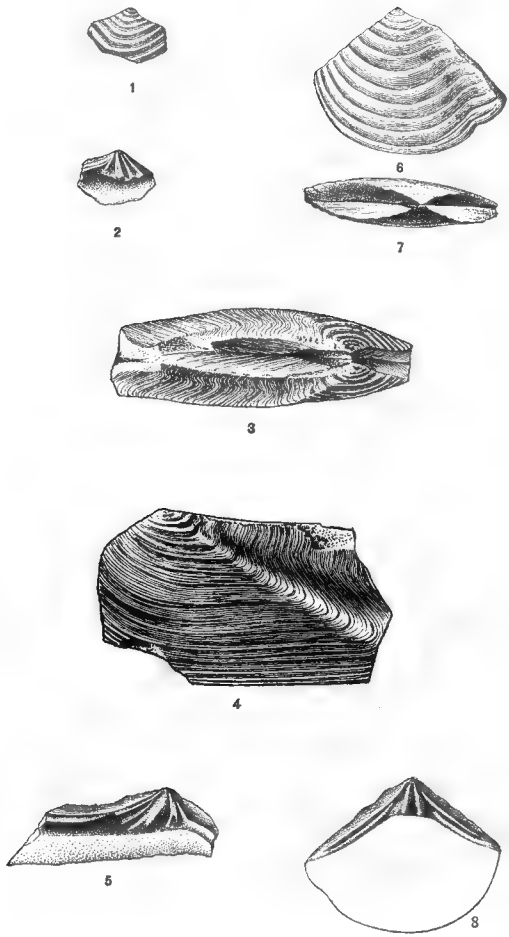
Page.

FIG. 1. Fragment showing the umbonal portion of a right valve.....
2. Hinge of same. (This is the hinge figured by Gabb in Paleontology of California, II, pl. 36, fig. 17a).....
3, 4. Two views of Gabb's other figured type.....
5. Hinge of left valve from a specimen in the type lot..... 299

Remondia robbinsi (White).

6, 7. Two views of one of the types (from the original drawings published by White).....
8. Hinge of left valve of another specimen (from the original drawing of a type)..... 300

[1] I have not had access to the description and figures of this species.



GENUS REMONDIA.

FOR EXPLANATION OF PLATE SEE PAGE 301.

DESCRIPTIONS OF TERTIARY FOSSILS FROM THE ANTILLEAN REGION.

By R. J. LECHMERE GUPPY, F. L. S., F. G. S.,
Port-of-Spain, Trinidad,

and

WILLIAM HEALEY DALL,
Honorary Curator of the Department of Mollusks.

SOME TIME since, the United States National Museum acquired by purchase the collection of Antillean Tertiary fossils made by the senior author of this paper, containing many types and also some new but undescribed forms. Mr. Guppy forwarded descriptions of the latter for publication in the Proceedings of the United States National Museum. Owing to the absence of named collections and works of reference in Trinidad, some changes were necessary to prepare the paper for printing, and at Mr. Guppy's request I have revised the manuscript, supervised the preparation of the figures of the new species, and added descriptions of some other new forms in the National Museum collections from the same region.

The sources of the fossils are as follows:

Pliocene.—The marls of Moen, Costa Rica, and vicinity afford many finely preserved Pliocene fossils, which have been collected and described by W. M. Gabb, and from which R. T. Hill has also obtained some material.

Miocene.—Beds in the Isthmian region, and also in Jamaica, and the Caroni beds of Trinidad have long been referred to the Miocene, from their obvious relations to the so called Miocene of Bordeaux and Dax; others of analogous age were discriminated by me from the Chesapeake Miocene of Virginia, Maryland, and Florida under the name of the Chipolan or Old Miocene. Subsequent studies have shown that all these beds, including those of Bordeaux, are referable to what is now known as the Oligocene or uppermost Eocene horizons. No strictly Miocene strata have yet been discriminated in the Antillean region,

and it is probable that the general elevation of the Antillean and Middle American lands, which is known to have taken place about the end of the Oligocene, maintained all of the present land areas above the level of the sea during the Miocene period. The strata of true Miocene in Florida are known to be extremely thin, and may probably have run out altogether a little farther south.

Upper Oligocene.—The Bowden and Clarendon marls of Jamaica, though only a few feet in thickness, are extremely rich in well-preserved fossils, many of which are common to the Chipola beds, Tampa, and Chattahoochee horizons of Florida, corresponding to the Aquitanian of France. The deposits in Jamaica have been explored by Vendryes, from whom Mr. Guppy received most of his Jamaican material; by Henderson and Simpson, for the National Museum, and by R. T. Hill, under the auspices of Dr. Alexander Agassiz. Similar beds in Santo Domingo and Haiti have been the source of specimens described by Sowerby and Gabb, and collections made by Rowell and Bland. Mr. Guppy has also described a number of species from this island. On the isthmus in the upper marls of Monkey Hill, in the Naparima beds of Trinidad, in Curaçao and elsewhere, there appear to be strata referable to the same series. Mr. Guppy recognizes the following horizons in Trinidad: Ally Creek shell bed, Naparima; Leda and Nucula beds, Naparima; Ditrupa bed, Pointapier. The last mentioned is evidently due to deposition in deeper water than the others. In all the Trinidad beds the fossils are less well preserved than in Jamaica, Haiti, and the Isthmus of Darien.

Lower Oligocene.—The Guallava sandstones of Costa Rica afforded Mr. Hill a few typical Vicksburgian species, being the southernmost point at which characteristic Vicksburg fauna has yet been recognized.

Eocene.—The Gatun beds of Conrad and Hill, the lower marls of Monkey Hill, and the Mindi Hill beds of the Panama Isthmus, are Eocene and contain a fair proportion of species common to the Claibornian of Alabama and the Upper Tejon of California. Among these may be mentioned *Lupia perorata*, Conrad, *Solarium alveatum*, Conrad, *Lunatia eminula*, Conrad, several species of Naticoids and *Cerithiopsis*, *Turritella ucasana*, Conrad, and the genus *Glyptostyla*. Some of the species, like *Venus wallii*, Guppy, and *Cardium haitensis*, Sowerby, appear to survive into the Oligocene. This horizon has been explored by Rowell, Conrad, Gabb, and others. The Manzanilla beds of Trinidad were probably contemporaneous.

The list of Tertiary fossils of the West Indian region, prepared by Mr. Guppy in 1874,[1] comprised some 250 species of fossil mollusks, but the fauna is much richer than this, since in one day, at the Bowden beds, Messrs. Henderson and Simpson procured over 400 species. A significant proportion of these appear to have survived little changed, or to be represented by closely analogous species in the recent fauna of

[1] Geol. Mag., Decade II, I, Nos. 9 and 10, Sept. and Oct., 1874.

the West Indies, while the corals, which are described by the late P. M. Duncan, are remarkably different from those of the existing fauna.

In the present paper those species followed by the name of Mr. Guppy were described by him, the others by the writer. Mr. Guppy notes that the new species from the Trinidad rocks, herein described, have for the most part been detected since 1890, during his reexploration of the microzoic rocks of the island. The strata are briefly described in his paper on the "Tertiary microzoic formations of Trinidad," read before the Geological Society of London in June, 1892, and published in the issue of the Journal of the society for November, 1892.

WM. H. DALL.

DESCRIPTION OF THE SPECIES.

RINGICULA, doubtful species, junior.

Oblong-ovate, turrited; whorls 5, spirally ribbed by rounded costæ with narrow (linear) interstices; aperture suboval; columella with two strongly twisted folds; spire conic; apex smooth, blunt. Length 3 mm., breadth 2 mm. [G.]

Ditrupa bed, Pointapier, Trinidad, Guppy (2270). No. 107108, U.S.N.M. Shells all incomplete and too young to name or discriminate, but useful as establishing the presence of this genus in the beds.

TORNATINA BULLATA, Kiener.

T. canaliculata, ORBIGNY, Moll. Cuba, I, p. 133, pl. IV *bis*, figs. 21–24, 1853; not of SAY.

Oligocene of Jamaica (Guppy, 2267). No. 107110, U.S.N.M.

PLEUROTOMA VENUSTA, Sowerby.

P. venusta, SOWERBY, Journ. Geol. Soc. Lond., VI, p. 50, pl. X, fig. 7, 1849.
P. jamaicense, GUPPY, Journ. Geol. Soc. Lond., XXII, p. 290, pl. XVI, fig. 6, 1866.

Oligocene of Jamaica and Haiti; Ditrupa bed, Pointapier, Trinidad, Guppy (2118, 2255). No. 107140, U.S.N.M. Very young specimens of several other species were obtained from this locality, but they were not sufficiently matured for description.

CLATHURELLA AMICTA, Guppy, new species.

(Plate XXVII, fig. 12.)

Fusiform-ovate with longitudinal ribs crossed by revolving (spiral) ridges which rise upon them; whorls about 7, strongly keeled in the middle by one of the most prominent of the revolving ridges, sometimes the uppermost one, but in other examples the third or fourth; aperture elongate-oval; peristome broadly expanded and reflected; sinus produced. Alt., 4.6 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2273). No. 107142, U.S.N.M.

CLATHURELLA VENDRYESIANA, Dall, new species.

(Plate XXVII, fig. 1.)

Acuminate, fusiformly oblong-turrited, closely and regularly cancellate; Longitudinal sculpture boldest on upper whorls, except the first two, which are quite smooth; whorls 8, the last forming about one-half; upper angle of whorls forming a slight keel, upon which the longitudinal striæ become sinuate; aperture oblong, narrow; canal and sinus broad and deep; lip much thickened. Length 14 mm., breadth 5 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2284). No. 107086, U.S.N.M. This species was sent by Mr. Guppy under the manuscript name *formosa*, which is preoccupied in the genus *Clathurella* by Jeffreys, 1883.

CYTHARA GIBBA, Guppy, new species.

(Plate XXVII, fig. 9.)

Much resembling *C. biconica*, Reeve, but smaller and proportionately shorter. Alt., 3.8 mm.

Oligocene of Jamaica, Vendryes (Guppy, 2274). No. 107143–4, U.S.N.M.

CYTHARA GUPPYI, Dall, new species.

(Plate XXVII, fig. 5.)

This differs from *C. biconica*, Reeve, by its less angular shoulder, its lower, more rounded, and delicate ribs, and smaller nucleus. Alt. 6.5 mm.

Oligocene of Jamaica, Vendryes (Guppy, 2275). No. 107145, U.S.N.M. This was sent under the preoccupied manuscript specific name of *gibberosa*, Guppy, for which I have substituted the above designation.

CYTHARA MUCRONATA, Guppy, new species.

(Plate XXVII, fig. 6.)

Fusiformly oblong, acuminate, cancellate, the longitudinal ridges being usually but not always the stoutest; whorls 5, the two apical ones large and smooth; suture marked by a prominent smooth, revolving ridge; last whorl more than one-half the shell; aperture suboval elongate; canal and sinus well developed; lip thickened. Alt. 5.5 mm., lat. 2.5 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2286). No. 107087, U.S.N.M.

CYTHARA OBTUSA, Guppy, new species.

(Plate XXVII, fig. 7.)

Ovate-fusiform, longitudinally ribbed by costæ which are sinuate on the angle of the whorl and about the same width as their interstices, which are crossed by fine lines; whorls about 7, somewhat convex and

angulated; apex obtuse, the three apical whorls smooth; aperture narrow, produced into a moderate canal; lip thickened, notch very distinct. Length 6 mm., breadth 1.5 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2286). No. 107088, U.S.N.M. The preceding species of *Cythara* are on the border line between the typical *Cytharæ* and the small *Mangiliæ*, and might, with almost equal pertinency be included in either subdivision of the genus.

MANGILIA CONSENTANEA, Guppy, new species.

(Plate XXVII, fig. 4.)

Fusiform-turrited; whorls about 8, sharply angulate, spirally lirate, the strongest thread forming the angle of the whorls and rising like the other threads into knobs upon the longitudinally elongate or variciform tubercles; surface of whorl above the keel minutely lirate by fine spiral threads, aperture elongate, terminating in a moderate canal. Length 6.2 mm., breadth 2 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2289). No. 107091, U.S.N.M. This species is closely related to such species as *M. cerina*, Kurtz and Stimpson, *M. limonitella*, Dall, and other recent forms which are characterized by a microscopically granular surface.

MANGILIA, doubtful species.

Oligocene of Jamaica, Guppy (2273). No. 107142, U.S.N.M. One or two indeterminable young shells, not of any of the above-mentioned species, were included in the same lot with *Clathurella amicta*.

CANCELLARIA ROWELLI, Dall, new species.

(Plate XXIX, fig. 1.)

Shell solid, acute, with seven moderately rounded whorls; suture well marked; spiral sculpture of numerous flat, little-elevated, narrow bands with narrower interspaces, the bands becoming more rounded, prominent, and somewhat alternated on the base; transverse sculpture of numerous low, narrow, flattish riblets with their posterior edges higher and sharper, crossing the spirals without interruption except on the base, and slightly nodulated by the two or three spirals in front of the suture; pillar constricted above the somewhat imbricated siphonal fasciole; aperture longer than wide, pillar with a wash of callus, and three plaits progressively less strong beginning with the posterior which crowns the fasciole; umbilicus none; body hardly callous; outer lip thickened, not reflected, obliquely receding in front, internally with sharp, distant lirations; canal short, recurved. Alt. 25, max. lat. 13 mm.

Potrero, Rio Amina, Santo Domingo, Rowell, in what are probably Oligocene strata. No. 113762, U.S.N.M. This species is named in honor of Rev. J. Rowell, an old collaborator of the Smithsonian Institution, and a pioneer of 1849 in California. It is perhaps most nearly

related to *C. arcolata*, Hinds, found living on the west coast of Middle America.

OLIVA PLICATA, Guppy, new species.

(Plate XXX, fig. 12.)

Cylindrical; spire conic; apex prominent; whorls 7; suture deeply channeled; columella with 10–12 strong plaits. Alt. 12.2, lat. 5 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2288). No. 107090, U.S.N.M.

OLIVELLA INDIVISA, Guppy, new species.

(Plate XXX, fig. 10.)

Elongate-conic; whorls about 6, the last about three-fourths of the length of the shell. Allied to *O. oryza*, of which it may be considered a Miocene form. Alt. 6.5, lat. 1.5 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2287). No. 107089, U.S.N.M.

OLIVELLA, doubtful species.

Specimens of very young and indeterminable species of *Olivella* were found in some numbers in the Ditrupa bed at Pointapier, Trinidad, by Guppy.

MARGINELLA SOLITARIA, Guppy, new species.

(Plate XXIX, fig. 14.)

Oblong; whorls about 4; spire conic; apex obtuse; aperture somewhat narrow, expanded anteriorly into a round, spout-like canal; lip thickened and strongly (4) dentate; columella twisted, with two strong folds and two teeth on the body whorl. Alt. 3, lat. 1.5 mm. [G.]

Ditrupa bed, Pointapier, Trinidad, Guppy (2268). No. 107139, U.S.N.M.

MARGINELLA (PERSICULA) ARCUATA, Guppy, new species.

(Plate XXIX, fig. 13.)

Oval, solid, somewhat flattened; inner lip strongly dentate, outer lip sharp, dentate within; aperture curved, as long as the shell; spire very short. Alt. 4.5, lat. 3.5 mm. [G.]

Ditrupa bed, Pointapier, Trinidad, Guppy (2253). No. 107141, U.S.N.M. The only specimen is obviously immature, but is related to *M. gravida*, Dall, and its predecessors in the Floridian Chipola beds.

MARGINELLA LATISSIMA, Dall, new species.

(Plate XXIX, fig. 11.)

Shell small, very solid and broad, externally smooth and polished, a wash of callus obscuring a very low spire of about 3 whorls; base callous; outer lip broad, thick, with a groove behind it and a low callus

on the shoulder behind the groove; aperture narrow, the outer lip smoother in front and behind, minutely denticulate near the middle; inner lip thickened; body with two transverse plaits, the posterior smaller; pillar short, with two oblique plaits, the anterior smaller. Lon. of shell 11, lat. 8.5 mm.

Pliocene clays of Moen, Costa Rica, Gabb; also from Santo Domingo, Bland. This is perhaps the shortest and widest American species.

MARGINELLA LIMONENSIS, Dall, new species.

(Plate XXIX, fig. 12.)

Shell large, thin, slender, anteriorly attenuated, of about 4 whorls; surface smooth, polished, the spire low, pointed, much obscured by enamel; aperture not quite as long as the shell, narrow, slightly wider in front and behind; outer lip thickened, incurved, smooth, on the outside, with a shallow sulcus marking off the lip from the whorl behind it; pillar lip hardly callous except near the spire; in front with four subequal oblique plaits, of which the anterior one is coincident with the border of the canal. Lon. 30, lat. 14 mm.

Pliocene clays of Limon, Costa Rica, Hill. No. 107076, U.S.N.M. This species recalls *M. antiqua*, Redfield, from the newer Miocene of Duplin County, North Carolina, but is smaller, more slender, with proportionately more prominent spire.

MARGINELLA AMINA, Dall, new species.

(Plate XXIX, fig. 15.)

Shell elongated, heavy, somewhat attenuated in front, with about 4 whorls; surface smooth, polished, spire rather more pointed and distinct than in *M. limonensis*, and with less enamel on it; aperture narrow, nearly straight, nearly as long as the shell; not widened behind; outer lip thick and heavy, profusely crenulated from end to end, on the outside with a very deep profoundly excavated sulcus, except above the shoulder, where there is a thick, callous deposit; pillar lip with a wash of callus, anteriorly with 4 plaits, the posterior pair transverse, the anterior oblique, enlarging forward; canal wide, excavated. Lon. 25, lat. 13 mm.

Potrero, Rio Amina, Santo Domingo, in Oligocene beds, Bland. This species is shorter, broader, and heavier than *M. limonensis*, from which it is further distinguished by its strongly crenulated lip and the extremely deep sulcus behind the lip.

MARGINELLA CONIFORMIS, Sowerby.

Marginella coniformis, SOWERBY, Quart. Journ. Geol. Soc. London, VI, p. 15, 1849.

Oligocene of Haiti and Santo Domingo, Sowerby and Bland, and of Jamaica, Barrett. No. 113769, U.S.N.M. The most abundant Santo Domingo *Marginella* is the *M. coniformis*, not figured by Sowerby, but

subsequently by Guppy.[1] In looking over the Guppy collection, now in the National Museum, I find a species from Cumana, labeled *M. coniformis*, but which can not be distinguished from *M. cincta*, Kiener (No. 115599, U.S.N.M.); and another similarly named from Montserrat, Trinidad, which is a *Persicula*, closely related to *P. obesa*, Redfield.

MARGINELLA DOMINGOENSIS, Dall, new species.

Oligocene of Santo Domingo, from an island in Lake Henriquillo, and also from the Potrero, Rio Amina, Bland. Nos. 113683, 113768, U.S.N.M. This species is very close to *M. aurora*, Dall,[2] from the Chipola marl, but has the tip of the spire less conspicuous and the aperture quite flexuous instead of nearly straight.

PHOS METULOIDES, Dall, new species.

(Plate XXVIII, fig. 15.)

Shell small, solid, with 7 moderately rounded whorls, elegantly, evenly, reticulately sculptured by numerous subequal, flat, strap-like spirals and subflexuous transverse riblets with about equal interspaces and slightly nodulous at the intersections; aperture small, semilunate, the outer lip thickened and sharply lirate within, sharp edged, and anteriorly receding; body and pillar with little callus, and no marked constriction above the fasciole, which latter is marked by 5 spiral, flat riblets crossed by flexuous incremental lines and bounded on either side by the ordinary sculpture without any marked keel. Lon. 20, lat. 9 mm.

Ponton, Santo Domingo, Bland, in the Oligocene; also at Monkey Hill, on the Isthmus of Panama, in the Oligocene marl.

The sculpture of this species strongly recalls that of *Metula cancellata*, Gabb, from the same horizon. Fragments indicate that it reaches a much larger size than that above given.

PHOS GABBII, Dall, new species.

(Plate XXIX, fig. 4.)

Phos veraguaensis, GABB, Geol. Santo Domingo, p. 212, 1873, not of HINDS.
Phos moorei and *elegans*, GABB, loc. cit., not of GUPPY.

The present species is most like *P. fasciolatus*, from which it can be instantly distinguished by its unarmed fasciole, over which the sculpture of the adjacent whorl passes without any marked interruption, much as it does in *P. metuloides*. There are 20 ribs on the last whorl against 14 in *P. fasciolatus*. There are numerous small callous ridges on the pillar, which is anteriorly keeled. The shell is 24 mm. long and 11.5 mm. wide.

[1] Geol. Journ., XXII, p. 288, pl. XVII, fig. 2, 1866.
[2] Trans. Wagner Free Inst. Sci., III, p. 51, pl. VI, fig. 4a.

Santo Domingo, Gabb; Potrero, Rio Amina, Bland; Jamaica, Barrett; in the Oligocene. In his paper above cited Gabb confused three different species of *Phos* under a name which belongs to none of them. *P. elegans* and *P. moorei* of Guppy are excellent species, and neither is identical with the recent Pacific Coast species of Hinds.

PHOS (STRONGYLOCERA) FASCIOLATUS, Dall, new species.

(Plate XXVIII, fig. 12.)

Shell solid, acute, with 1½ smooth, nuclear, and 7 strongly sculptured, well rounded whorls; spiral sculpture of numerous flat spiral bands separated by narrow grooves, alternated on the earlier whorls, stronger on the base and more or less swollen on the spire when they pass over the ribs; transverse sculpture of (on the last whorl 14) numerous elevated, even, rounded, subequal ribs extending clear over the whorls and separated by wider interspaces; suture distinct; aperture subovate with a strong callus on the body and pillar, where there are a few faint tubercles, while the anterior edge of the pillar is marked by a sharp spiral keel; outer lip thickened, lirate; canal short, recurved; siphonal fasciole strong, keeled on each side, with a succession of prominent, sigmoid, elevated lamellæ between the keels. Lon. 24, lat. 11.5 mm.

Oligocene at the Potrero, Rio Amina, Santo Domingo, Bland. No. 113778, U.S.N.M. This species is nearest to *P. semicostatus*, Guppy, and *P. guppyi*, Gabb, both of which are easily discriminated by the differences in sculpture.

PHOS (STRONGYLOCERA) CHIPOLANUS, Dall, new species.

Shell acute, with 2 smooth, nuclear and 7 strongly sculptured whorls, somewhat appressed at the suture; spiral sculpture much as in *P. semicostatus* of small, stout, rounded, partly alternated ridges swollen where they pass over the ribs, sparser and stronger on the base; transverse sculpture of (on the last whorl 7) strong, rounded ribs, evenly distributed and most prominent at the periphery; aperture wide, the outer lip lirate, the pillar keeled and reflected on the anterior edge; a sharp constriction and keel behind the siphonal fasciole, which is flexuously and imbricately sculptured transversely with a few small, spiral grooves; a moderate callus on the body and pillar. Lon. 25, lat. 13 mm.

Oligocene of the Chipola beds, Calhoun County, Florida, Dall. No. 114191, U.S.N.M. This species is most nearly related to *Phos solidulus* (Guppy as *Nassa*), *P. semicostatus*, Gabb, and *P. guppyi*, Gabb, all of which are well distinguished by sculpture and details of form. Among recent species *Phos unicinctus*, Say (as *Nassa*), is allied. I have already shown[1] that the last mentioned is distinguished both from *Phos* and *Nassa* by its operculum, which is lozenge-shaped, pointed in front and behind with a subcentral nucleus and concentric elements. The shell

[1] Blake Gastr., Bull. Mus. Comp. Zool., XVIII, p. 178, 1889.

is more like *Phos* than *Nassa*, and was named *Phos guadelupensis* by Petit in 1852. It is distinguished from the typical species of *Phos* by the excavation of the upper part of the whorls, and is one of the two species cited by Mörch under his undefined genus *Strongylocera*. The other species, *P. cancellatus*, Quay and Gaimard (not A. Adams), is a synonym of *P. textus* according to Tryon, and is a true *Phos*. The name *Strongylocera* may therefore, perhaps, be revived with advantage for species of the *unicincta* type, with a concentric operculum, and, among the fossils, *P. solidulus*, Guppy, *P. chipolanus*, Dall, *P. fasciolatus*, Dall, *P. costatus*, Gabb, and *P. erectus*, Guppy, should be referred to it.

Genus STROMBINELLA, Dall.

Shell slender, elongated, with a presutural cingulum and a strong node behind the outer lip, near the suture, in the adult; otherwise sculptured like *Anachis*. This form appears at first sight like a small strongly sculptured *Terebra*, of the section *Acus*, but the aperture is that of *Anachis*, to which it doubtless bears much such a relation as *Æsopus* does to *Astyris*.

Type.—Strombinella acuformis, Dall.

STROMBINELLA ACUFORMIS, Dall, new species.

(Plate XXIX, fig. 6.)

Shell small, elongate, acute, slender, with 2 smooth nuclear and 9 or 10 sculptured whorls; spirally sculptured only on the base of the last whorl by narrow, deep grooves separated by wider, rounded threads, which become finer on the canal; transverse sculpture of (on the last whorl 12) strong, flexuous ribs extending from suture to suture, and united in front of the suture by a low, flattish, revolving ridge, which develops strong nodules at the intersections with the ribs; the last third of the last whorl is destitute of ribs, but the cingulum continues and terminates in a prominent node behind the outer lip; aperture small, semilunar, with a thin callus on the pillar, through which the spiral sculpture shows; the outer lip sharp, flexuous, somewhat expanded, with 1 to 3 coarse liræ internally; canal short, very deeply cut; pillar thin, gyrate, leaving a pervious axis. Lon. 13.5, lat. 3.5 mm.

Oligocene of the Potrero, Rio Amina, Santo Domingo. No. 113784, U.S.N.M. Two specimens of this elegant and interesting little shell were obtained from a correspondent and given to the Museum by the late Thomas Bland.

STROMBINA MIRA, Dall, new species.

(Plate XXIX, fig. 7.)

Shell small, solid, acute, with 7 whorls; the spire smooth except for a small ridge in front of the narrowly channeled suture; the last whorl finely spirally grooved below the periphery and on the pillar; aperture

long, narrow, the pillar and body with a moderate callus; pillar and canal short, hardly recurved; outer lip tumid, coarsely lirate within. Lon. 9, lat. 4.5 mm.

Oligocene of the Isthmus of Darien, near Gatun, Rowell, Hill, and others. No. 113713, U.S.N.M. This little shell has the aspect of an *Astyris*, but the aperture of a *Strombina*. It may be mentioned here that the *Planaxis crassilabrum* of Guppy, from the Tertiary of Trinidad, is founded, according to the types, on defective specimens of a *Strombina*, which is probably *S. haitensis*, Gabb.

TYPHIS, doubtful species.

Ditrupa bed, Pointapier, Trinidad, Guppy (2136). No. 107136, U.S.N.M. This species, represented by an extremely small immature specimen, was referred by Mr. Guppy to *T. alatus*, Sowerby, but a careful examination of it shows that it is more nearly related to *T. linguiferus*, Dall, of the Chipola, Florida, Oligocene and to *T. recurvirostratus*. Until a more mature specimen is obtained it would be inadvisable to apply a specific name to this species.

TYPHIS OBESUS, Gabb.

Typhis obesus, GABB, Geol. Santo Domingo, 1873, p. 203.

Oligocene of Santo Domingo, Gabb; of Jamaica, Vendryes and Hill; of the Chipola marl, Calhoun County, Florida, Dall and Burns. Nos. 115494, 112182, and 107455, U.S.N.M. This species was collected in Jamaica by Vendryes and named *T. alatus* in the Guppy collection, but it appears to be a sufficiently distinct species from Sowerby's shell and much more common. It is also found, rarely, in the Chipola marl.

A third species of *Typhis* from Jamaica is represented in the collection of the National Museum by a single, not very well preserved, specimen. It is closely related to, if not identical with, *T. floridanus*, Dall, of the Chipola marl.

In this connection the following notes on species cited in Mr. Guppy's catalogue of West Indian Tertiary fossils may not be out of place: *Trophon dominicensis*, Gabb, is a well-marked species of *Murex*, from which *Murex collatus*, Guppy, is perfectly distinct. *Purpura miocenica*, Guppy, is a *Coralliophila*, probably identical with a species now existing and commonly known as *C. galea*, Chemnitz. *Fasciolaria tarbelliana*, Grateloup, is a species of *Latirus*.

ACLIS ACUMINATA, Guppy, new species.

(Plate XXVIII, fig. 9.)

Elongate-turrited, smooth, shining; whorls about 9, slightly convex; suture well marked, overhung by the whorl above; aperture subquadrate; columella lip reflected. Alt. 3, lat. 0.5 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2279). No. 107081, U.S.N.M. This curious little shell appears to be an *Aclis*, but might possibly be the young of a smooth *Turbonilla*.

Subgenus **AMBLYSPIRA**, Dall.

ACLIS ? (AMBLYSPIRA) TERES, Guppy, new species.

(Plate XXVIII, fig. 6.)

Elongate-turriculate, somewhat arcuate, ivory-shining, covered with enamel-like deposit; whorls about 7, flattened, except the earlier ones, which are sometimes more or less rounded; suture scarcely distinct except between the earlier whorls; aperture elongate. Alt. 2, lat. 0.5 mm. [G.]

Ditrupa bed, Pointapier, Trinidad, Guppy (2252). No. 107073, U.S.N.M. This and the following species belong to a group of minute shells between *Aclis* and *Eulima* conchologically, characterized by their blunt apex and short base with subcylindric form, which may, however, be varied by the overhang of the whorls. They are rather characteristic of deep water, and a number of undescribed recent species have been obtained from 400 or 500 fathoms off the coast of Florida. The apex resembles that of *Eulima* externally, but the shell has more the aspect of some of the Aclides. *A. teres* may be taken as the type, for which I propose the subgeneric name *Amblyspira*.

ACLIS? (AMBLYSPIRA) PROMINENS, Guppy, new species.

(Plate XXVII, fig. 11.)

Subrimate, conic-turrited; whorls about 9, strongly carinate; the keel overhanging the suture, thereby causing the latter to be deeply sunk, especially on the later whorls; aperture somewhat angulate and forming an obsolete canal above. Alt. 4, lat. 1.5 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2271). No. 107072, U.S.N.M.

ACLIS? (AMBLYSPIRA), doubtful species.

Subrimate, turrited-cylindric; whorls 4–5, smooth, slightly convex, carinate at the line of suture; aperture simple, suboval; columellar margin slightly reflected. Alt. 2, lat. 0.5 mm. [G.]

Ditrupa bed, Pointapier, Trinidad, Guppy (2272). No. 107112, U.S.N.M. These specimens are evidently immature, and do not afford material for a complete specific diagnosis.

EULIMA EGREGIA, Guppy, new species.

(Plate XXVIII, fig. 11.)

Turrited, smooth; whorls about 14, slightly convex; suture well marked, simple, linear; aperture suboval; columella callus reflected over the body whorl. Alt. 29, lat. 10 mm. [G.]

Tertiary beds of Monserrat, Trinidad, Guppy (2282). No. 107082, U.S.N.M. A remarkably fine large species with exceptionally conspicuous sutures.

EULIMA (LIOSTRACA) NOBILIS, Guppy, new species.

(Plate XXX, fig. 9.)

Very elongate, subulate; whorls 10 or more; spire sharp (imperfect in our specimens); suture not visible; aperture oblong, narrow, widening anteriorly; body with a callus extending to the slightly reflected but sharp pillar lip. Alt. 7, lat. 2 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2132). No. 107071 U.S.N.M.

EULIMA, doubtful species.

Elongate, subulate; whorls 8 or 9; spire sharp; suture masked by enamel; aperture elongate, with a callus on the body. Alt. 4, lat. 1 mm. [G.]

Ditrupa bed, Pointapier, Trinidad, Guppy (2133). No. 107111, U.S.N.M. Probably young specimens of *E. nobilis*, but if not, too imperfect for description.

PYRAMIDELLA (LONGCHÆUS) JAMAICENSIS, Dall, new species.

(Plate XXIX, . 10.)

Shell small, subcylindrical, with 7 or 8 whorls, smooth, polished, with a deep, square-cut channel at the periphery, the bottom of which is crossed by transverse, elevated lines in harmony with the lines of growth; the suture is wound about the shell a little in advance of the periphery near but not at the groove, giving the effect of duplication; base rounded, smooth; a strong plait encircles the pillar and emerges some distance from the aperture, a minor fold is seen on the anterior part of the pillar, but does not emerge; aperture at the base of the pillar angular, almost channeled; outer lip sharp, not lirate inside. Lon. 3.25, lat. 1 mm.

Oligocene of Jamaica, Bowden marl. No. 115642, U.S.N.M. This species is smaller than any of the others from the same region and has a much stronger peripheral groove in proportion to its size.

PYRAMIDELLA (LONGCHÆUS) FORULATA, Guppy, new species.

(Plate XXVIII, fig. 13.)

Elongate, ovate-conic, smooth; whorls about 7, with a single square groove along the line of suture; aperture suboval; columella strongly twisted with three folds or plaits; a square, spiral groove runs along above the suture just where it is joined to the succeeding whorl, producing the appearance of a squarely sunk suture. Alt. 5, lat. 2 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2259). No. 107118, U.S.N.M. Allied to *O. cinctus* and *O. hastatus*, Adams.

PYRAMIDELLA (LONGCHÆUS), doubtful species.

Ditrupa bed, Pointapier, Trinidad, Guppy (2260). No. 107119, U.S.N.M. These fragments are obviously the young of a larger species, perhaps the preceding. They do not offer satisfactory characters for a specific description.

TURBONILLA PLASTICA, Guppy, new species.

(Plate XXVIII, fig. 4).

Elongate turrited, longitudinally ribbed, the ribs narrower than their spirally-striate interstices; whorls about 7, exclusive of the apex, which is large, sinistral, smooth, and composed of about 3 turns set on in a plane continuous with the axis of the shell and at right angles to the plane of the succeeding whorls; aperture simple, ovate; columella reflected. Alt. 3.5, lat. 1 mm. [G.]

Ditrupa bed, Pointapier, Trinidad, Guppy (2123). No. 107113, U.S.N.M. Distinguished by its larger nucleus from *T. turris*, Orbigny, and the following species:

TURBONILLA TURRITISSIMA, Guppy, new species.

(Plate XXVIII, fig. 5.)

Subulate-turrited, many-whorled, longitudinally ribbed, the interstices between the ribs cancellated by less-pronounced spiral lines. Whorls (?15) slightly rounded; aperture suboval, with a slightly twisted columella. Length of a large imperfect example 8, breadth 2 mm. Length of a small perfect example 5, breadth 1.5 mm. A large example has 10 whorls, but the spire is broken. A smaller example has 9 to 10 whorls. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2258). No. 107114, U.S.N.M. The following forms are as distinct as species usually recognized in this group, but believing the range of variation to be much greater than usually allowed for, I am inclined to think they may eventually prove varieties of the preceding species. [G.]

TURBONILLA ANGULATA, Guppy, new species?.

(Plate XXVIII, fig. 10.)

A form with strongly angulate whorls giving a step-like appearance. In this the spiral striæ between the longitudinal ribs are fine and thread-like. Alt., 3.5 mm.

Oligocene of Jamaica, Vendryes, (Guppy, 2258a). No. 107115, U.S.N.M.

TURBONILLA SIMPLICIOR, Guppy, new species?.

(Plate XXVIII, fig. 1.)

This has a stouter appearance. A specimen of it with 15 whorls has a tendency to a subquadrate shape of aperture. It has no spiral lines between the longitudinal riblets. Alt., 7.5 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2258b). No. 107116, U.S.N.M.

TURBONILLA TENUILINEATA, Guppy, new species?.

(Plate XXVIII, fig. 8.)

In this form, which would generally be regarded as a distinct species, the ornamentation is reduced to 4 or 5 very fine spiral lines. The aperture is subquadrate in our specimens, but this feature may vary to some extent. Alt., 5 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2258c). No. 107117, U.S.N.M.

TURBONILLA (STYLOPSIS) OCTONA, Guppy, new species.

(Plate XXVII, fig. 8.)

Turrited, somewhat fusiformly cylindrical; smooth or only striate longitudinally by lines of growth; whorls about 4–5 (in addition to the discoid sinistral apex of about 3 turns set on at an angle), angulated above, and separated by a deep suture; aperture suboval, angulate above and somewhat produced anteriorly; columella reflected, the callus spread over the pillar lip. Alt. 1.25, lat. 0.3 mm. [G.]

Ditrupa bed, Pointapier, Trinidad, Guppy (2129). No. 107078, U.S.N.M. This may be compared with *Actis simillima*, Smith, from St. Helena, and *Eulima subcylindrata*, Dunker.

OSCILLA INDISCRETA, Guppy, new species.

(Plate XXVIII, fig. 14.)

Subulate-turrited; whorls about 9, flat, adorned with three strong squarish spiral ribs or keels, narrower than their deep interstices; the upper rib on a whorl in contact with the lower one on the preceding whorl, thus almost masking the suture; these two ribs sometimes nodulous; aperture suboval; base with a spiral rib dividing the space between the keel on the angle of the whorl from the plaited and twisted columella. Near the apex the lower and upper keels are more nodulous and are fused together so as to form apparently only one keel. Alt. 6, lat. 2 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2148). No. 107074, U.S.N.M. This may be compared with the recent *O.* (*Triptychus*) *nivea* of Mörch, from which it differs in details of sculpture, as also from the synonymous *O. biseriata*, Gabb, of the Costa Rica Pliocene.

ULTIMUS PRECURSOR, Dall, new species.

(Plate XXIX, figs. 2, 3.)

Shell solid, polished, with a strong, transverse, rounded dorsal keel, the enamel of the back leaving a considerable area uncovered; ends blunt; aperture wide; the outer lip very feebly cross-striated. Lon. 24.5, lat. 15 mm.

Pliocene clays of Limon, Costa Rica. No. 107456, U.S.N.M. This form differs from the recent *U. gibbosa* by the greater excavation of the slope from the dorsal keel forward, by the greater prominence of the keel, which is rather more posteriorly situated, by the more abrupt truncation of the posterior end, and by the somewhat greater proportional breadth. A larger area of the back is left without enamel in the adult than in *U. gibbosa*.

CARINARIA CAPERATA, Guppy, new species.

(Plate XXVII, fig. 14.)

Cornucopiæform, carinated, compressed, with 7 or 8 transverse ridges in harmony with the wavy incremental lines; keel somewhat plicate, spire short, the apex wanting in the specimens. Lon., 7 mm. [G.]

Shell bed of Ally Creek, Naparima, Trinidad, Guppy (2138). No. 107138, U.S.N.M. The shell itself being extremely fragile, can not be extracted, but the casts give a fairly accurate idea of its form. It is nearest to *C. paretoi*, Mayer, from the Langhian (Miocene) of Senavalle di Scrivia, Italy. That species is, however, much more numerously and evenly sculptured with rounded riblets, and attains a length of 19 mm.

TRIFORIS, doubtful species.

Sinistral, ovate-turrited; whorls 4–6, cancellated by 4 or 5 stout revolving ridges, crossed by finer costellæ, dividing the surface into rather square pits; base smooth, imperforate; aperture oval; columella twisted, continued into a spout-like canal. Alt. 1, lat. 0.5 mm. [G.]

Ditrupa bed, Pointapier, Trinidad, Guppy (2140). No. 107122, U.S.N.M. While sufficient to determine the presence of the genus *Triforis*, these minute and immature fragments are not capable of affording data for a specific description.

BITTIUM (STYLIFERINA) CERITHIDIOIDE, Dall.

Oligocene of Jamaica, Guppy (264). No. 107123, U.S.N.M. This widespread little shell extends from the Oligocene to the recent fauna of the Antilles with great uniformity of character.

BITTIUM (STYLIFERINA) PRÆFORMATUM, Guppy, new species.

(Plate XXVIII, fig. 2.)

Turrited, subulate, or rather fusiformly cylindrical, varicose, spirally lirate, and granulose; whorls about 12, slowly increasing, the last

scarcely exceeding the previous ones in diameter; canal short. Alt. 5.5, lat. 1.6 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2144). No. 107124, U.S.N.M. This form is very slightly removed from *B. adamsi*, Dall, but is somewhat more slender, with slight differences of sculpture.

PYRAZISINUS? HAITENSIS, Dall, new species.

(Plate. XXIX, fig. 8.)

Shell large, heavy, of more than 7 whorls; surface smooth or faintly spirally striated on the early whorls; the base flattish, disk-like, with strong spiral threads and flexuous incremental lines; transverse sculpture of 7 or 8 short, very high, compressed ribs, which do not reach the sutures; whorls moderately convex, appressed at the suture. Lon. of 4 whorls 40, lat. 25 mm.

Oligocene of the island of Haiti, from an island in Lake Henriquillo, Rowell. No. 113681, U.S.N.M. Two broken specimens, wanting both the aperture and the apex, are obviously of some Cerite. The peculiar sculpture recalls that of *Pyrazisinus cornutus* of the Oligocene of Florida, and what is left of the aperture is not inconsistent with the supposition that the shell was a species of that genus, to which it is provisionally referred.

Genus MODULUS, Gray.

Monodonta (*sp.*), GUPPY.
Pseudotrochus, HEILPRIN.

MODULUS MODULUS L. var. BASILEUS, Guppy.

Monodonta basilea, GUPPY, Geol. Mag., Dec. II, I, p. 442, Pl. XVI, fig. 2, 1874.

Oligocene of Jamaica, Vendryes. No. 107137, U.S.N.M. The young specimens forwarded are not distinguishable from some of the varieties of the recent *M. modulus* of the same age. The full grown *M. basileus* is somewhat characteristic, judging from the single type specimen, and may rank as a variety or subspecies.

CÆCUM, doubtful species.

Ditrupa bed, Pointapier, Trinidad, Guppy (2266). No. 107150, U.S.N.M. This species for which Mr. Guppy assigned the name of *C. annulatum*, Brown, var. *curtum*, is more nearly related to *C. instructum*, de Folin, of the Antillean recent fauna, but differs by its slightly smaller size and less prominent mucro.

TURRITELLA ARATA, Guppy, new species.

(Plate XXVIII, fig. 3.)

Elongate, conic-cylindric, many-whorled; whorls without any convexity, doubly keeled, the interstices between the spiral ridges occupying the middle of the whorl and carrying one or two scarcely visible

threads; aperture quadrate; suture fine, linear; base smooth. Alt. 10.3, lat. 1.5 mm. [G.]

Oligocene of Haiti, Guppy (2280). No. 107085, U.S.N.M.

TURRITELLA, doubtful species.

Shell bed, Ally Creek, Naparima, Trinidad, Guppy (2119). No. 107121, U.S.N.M. A specimen of *Turritella* or immature *Vermicularia* too imperfect to define specifically was obtained as above. Lon. 6, lat. 3 mm. It wants both apex and base, but is furnished with sharp, revolving ridges, of which two very prominent ones divide each whorl into three parts, of which the deep one next below the scarcely visible suture contains three fine spiral lines, and the narrower one on the middle of the whorls between the two prominent keels contains one fine spiral line.

MATHILDA PLEXITA, Dall, new species.

(Plate XXIX, fig. 5.)

Shell small, elongated, turrited, with deep sutures and 13 strongly rounded whorls; sculpture reticulate; spiral sculpture of 4 to 6 rounded prominent threads alternated with much finer threads; there are also 3 of intermediate size on the base; these are crossed by regularly spaced, very narrow laminar transverse ridges, which are slightly nodulous at the intersections; top and base of the whorls flattened, with a minute umbilical chink; aperture subovate, entire, with sharp margin, a little modified by the sculpture on the outer lip; throat not lirate, but the external sculpture indicated by shallow sulci. Lon. 18.3, lat. 6 mm.

Oligocene of Jamaica, Henderson and Simpson. No. 115436, U.S.N.M. (figured). Ditrupa bed, Pointapier, Trinidad, Guppy (2115). No. 107120, U.S.N.M.; fragment. This fine species has somewhat the aspect of a reticulated *Scala* of the subgenus *Acrilla*, under which name it was sent in. Beside the fragment sent by Mr. Guppy from Trinidad, it has also been noticed in the Oligocene beds of the Isthmus of Darien at Monkey Hill.

FOSSARUS (GOTTOINA) MUNDULUS, Guppy, new species.

(Plate XXVII, fig. 16.)

Turbinate, rimate; whorls 4–5, with spiral sculpture of subequal regular ridges, of which three are visible on the upper whorls, and these are simple, while on the last whorl the spiral sculpture is reticulated by transverse, elevated, incremental lines; suture deep and well marked; base with similar spiral sculpture and an extremely narrow umbilical chink; aperture circular, thickened, and slightly dentate or lirate. Alt. 3, lat. 2.75 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2291). Nos. 107093 and 107094, U.S.N.M. This species is not unlike some larger recent forms found in deep water off the southeastern coast of the United States.

ALABA TURRITA, Guppy, new species.

(Plate XXVIII, fig. 7.)

Shell elongate-turrited; whorls about 9, spirally lirate by somewhat obsolescent ridges; two rather broad varices on each whorl; not continuous on successive whorls; spire pointed; aperture suboval, slightly notched; peristome subcontinuous; columella expanded. Alt. 5, lat. 2.25 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2137). No. 107128, U.S.N.M.

SOLARIUM, doubtful species.

Orbicular, discoidal, depressed, widely umbilicate; surface corrugated by undulate rather flattened radiating ridges, narrower than their interstices and rising into tubercles on the angle of the whorl; crossed by revolving or spiral furrows, dividing the surface into somewhat square tesseræ; first 2 or 2½ whorls quite smooth; apex depressed; umbilicus encircled by rows (3) of strong rounded tubercles formed by a continuation of the sculpture on the flattened upper surface of the whorls. Alt. 1, lat. 3 mm. [G.]

Ditrupa bed, Pointapier, Trinidad, Guppy (2254). No. 107126, U.S.N.M. The presence of this very young specimen, which shows only enough of the adult characters to determine its place in the group of *S. elaboratum*, Conrad, suffices to establish the presence of the group in the fauna, though not to characterize the species.

RISSOA (ALVANIA) PARIANA, Guppy, new species.

(Plate XXIX, fig. 9.)

Shell conic-oblong, turrited; whorls about 6, decorated by about 4 spiral ribs narrower than their interstices, upon which rise into points somewhat stout longitudinal costæ forming subquadrate or oblong pits, in which some faint striæ may be observed; apex smooth; base with about 4 spiral ribs; lip stout, expanded. Alt. 2.3, lat. 1.5 mm. [G.]

Ditrupa bed, Pointapier, Trinidad, Guppy (2257). No. 107127, U.S.N.M.

BENTHONELLA TURBINATA, Guppy, new species.

(Plate XXVII, fig. 10.)

Turbinate subrimate, longitudinally sinuate-costate; whorls about 5, the apical ones (about 2) quite smooth, the others strongly ribbed by sinuate costæ, their wider interstices crossed by minute spiral striæ which are not visible on the ribs; aperture ovate; columella reflected. Alt. 1, lat. 0.78 mm. [G.]

Ditrupa bed, Pointapier, Trinidad, Guppy (2139). No. 107077, U.S.N.M. The presence of this genus (*Hela* of Jeffreys) in these beds is almost conclusive evidence of their deep water or archibenthal character.

RISSOINA BROWNIANA, Orbigny.

R. browniana, ORBIGNY, Moll. Cuba, II, p. 28, pl. XII, figs. 33, 34, 1853.

Oligocene of Jamaica, Vendryes (Guppy, 2261), Nos. 107129 and 107130, U.S.N.M.

RISSOINA SAGRAIANA, Orbigny.

R. sagraiana, ORBIGNY, Moll. Cuba, II, p. 25, pl. XII, figs. 4, 5, 1853.

Oligocene of Jamaica, Vendryes (Guppy, 2263). Nos. 107131 and 107132, U.S.N.M. This is *R. sagra* on the explanation of the plate and *sagraiana* in the text.

RISSOINA ELEGANTISSIMA, Orbigny.

R. elegantissima, ORBIGNY, Moll. Cuba, II, p. 26, pl. XII, figs. 27, 28, 1853.

Oligocene of Jamaica, Vendryes (Guppy, 2264). No. 107133, U.S.N.M.

RISSOINA STRIATICOSTATA, Orbigny.

R. striaticostata, ORBIGNY, Moll. Cuba, II, p. 27, pl. XII, figs. 30, 31, 1853.

Oligocene of Jamaica, Vendryes (Guppy, 2265). No. 107134, U.S.N.M.

HIPPONYX TORTILIS, Guppy, new species.

(Plate XXVII, fig. 15.)

Subovate, obliquely conic, with imbricating lamellæ, which are closely covered with radiating striæ; margin expanded. Lon., 6.5 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2276). No. 107147, U.S.N.M.

HIPPONYX SUBRUFUS, Carpenter.

Oligocene of Jamaica, Vendryes (Guppy, 2283). No. 107084, U.S.N.M. Exactly like recent specimens.

NATICA PERLINEATA, Dall.

N. perlineata, DALL, Blake Gastr., p. 294, 1889.

Recent in the Antilles, 70 to 229 fathoms. Fossil in the Tertiary beds of Monserrat, Trinidad, Guppy (2281). No. 107083, U.S.N.M. In this connection it may be stated that *Stomatia eidolon*, Guppy, from San Fernando, Trinidad, proves on more close study to be the operculum of a naticoid shell.

PHASIANELLA, doubtful species.

Ovate-conoidal, rimate, with about 5 whorls slightly convex, the last angulate on the periphery and comprising more than two-thirds of the whole shell; apex pointed; aperture suboval; a callus on the pillar, reflected over the umbilical chink. Alt. 4, lat. 3 mm. [G.]

Ditrupa bed, Pointapier, Trinidad, Guppy (2256). No. 107148, U.S.N.M. This is almost certainly identical with one of the small recent species, but the material is too meager for a positive decision on that point.

MICROGAZA ROTELLA, Dall.

M. rotella, DALL, Blake Gastr. Bull. Mus. Comp. Zool., XVIII, p. 357, pl. XXII, figs. 5, 5a (1881), 1889.

Recent in 70 to 805 fathoms in the Antilles. Fossil in the Oligocene of Bowden, Jamaica, Henderson and Simpson. Nos. 94994 and 107457, U.S.N.M.

This elegant and curious little shell is common in the Bowden marl and exactly agrees with the recent specimens with which it was compared. The variety *inornata*, Dall, was found with the typical form in the marl as in the sea.

DILLWYNELLA ERRATA, Guppy, new species.

(Plate XXVII, fig. 2.)

Subglobose turbinate, shining, smooth, or marked by obsolescent undulate lines of growth; whorls 3–4, rapidly increasing, somewhat compressed or flattened superiorly; aperture circular, effused below into a sort of expanded and channeled columellar lip; spire little elevated. Alt. 1.5, lat. 1.8 mm. [G.]

Ditrupa bed, Pointapier, Trinidad, Guppy (2126). No. 107135, U.S.N.M. This genus is now known to extend from the Claibornian Eocene to the recent fauna.

SOLARIORBIS CLYPEATUS, Guppy, new species.

(Plate XXVII, fig. 3.)

Depressed, scarcely conoidal; whorls about 3, flattened, lineated by fine spiral ribs, which are crossed by fine radiating lines of growth; margin of whorls strongly but somewhat sharply carinated, the keel being a round rib marked off from the whorl by a line; umbilicus small; base covered with revolving and radiating lines like those of the upper surface, but finer; apex smooth. Alt. 1.75, lat. 3 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2134). No. 107075, U.S.N.M.

CALLIOSTOMA ASPERRIMUM, Dall.

C. asperrimum, DALL, Bull. Mus. Comp. Zool., XVIII, p. 373 (1881), 1889.

Recent in the Antilles, 100 to 220 fathoms, Blake expedition. Oligocene of Jamaica, Vendryes (Guppy, 2293a). No. 107097, U.S.N.M.

CALLIOSTOMA PULCHER, C. B. Adams.

C. pulcher, ADAMS, Contr. Conch., p. 69, 1850, not of A. ADAMS, 1851.

Recent in the Antilles. Oligocene of Jamaica, Vendryes (Guppy, 2293b). No. 107096, U.S.N.M.

CALLIOSTOMA ROSEOLUM, Dall.

C. roseolum, DALL, Bull. Mus. Comp. Zool., XVIII, p. 366, pl. XXIV, figs. 6, 6a, 1889.

Recent in the Antilles, 15 to 200 fathoms. Fossil in the Oligocene of Jamaica with the preceding species (Guppy, 2293c).

CALLIOSTOMA CORBIS, Dall.

C. corbis, DALL, Bull. Mus. Comp. Zool., XVIII, p. 365, pl. XXXIII, fig. 1, 1889.

Recent in the Antilles, 220 to 450 fathoms. Fossil in the Oligocene of Jamaica, Vendryes (Guppy, 2294). No. 107098, U.S.N.M. This is perhaps the most common species of *Calliostoma* in the Bowden marl.

SOLARIELLA ALTIUSCULA, Guppy, new species.

(Plate XXVII, fig. 17.)

Somewhat turrited; whorls 5–6, adorned with sharp spiral ridges, of which only about 2 are visible on the upper whorls, 4 on the last whorl but one, and about 10 on the last whorl; three apical whorls smooth; umbilicus open, deep, with about 4 granular or tubercular ridges on the last whorl; base encircled with a strong sharp ridge; aperture subquadrate, almost circular. Alt. 6.3, lat. 7 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2269). No. 107125, U.S.N.M.

LIOTIA SIDEREA, Guppy, new species.

(Plate XXVII, fig. 18.)

Turbinate, rimate; whorls 5–6, covered with a fine, scaly ornamentation; two keels, one on the angle of the whorls and one halfway between that and the suture; suture deep, bordered by a dentate ridge; base ornamented with 6 to 7 rows of rather square granules, largest near a wrinkled and dentate callus surrounding the imperfect umbilicus; aperture circular; lip expanded anteriorly, continued over the body whorl by a callus; columella reflected. Alt. 3.5, lat. 3.5 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2292). No. 107095, U.S.N.M.

LIOTIA VERESIMILIS, Guppy, new species.

(Plate XXVII, fig. 13.)

Conic-pyramidal, umbilicate; whorls 5, spirally lirate by a few thread-like ridges, of which two are visible on the upper whorls, crossed by equally fine radiating threads which divide the surface into square areolæ; suture linear; aperture circular; lip continuous. Alt. 1.5, lat. 1.5 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2290). No. 107092, U.S.N.M.

? DENTALIUM HAITENSE, Gabb.

D. haitense, GABB, Geol. Santo Domingo, 1873, p. 244.

Oligocene of Jamaica, Vendryes (Guppy, 2278). No. 107080, U.S.N.M. Two very slender specimens appear to belong to this species. [G.]

DENTALIUM GOULDII, Dall.

D. Gouldii, DALL, Bull. Mus. Comp. Zool., XVIII, p. 424, pl. XXVI, fig. 4, 1889.

Recent in the Antilles (as *D. hexagonum*, Sowerby, not Gould), 12 to 150 fathoms. Fossil in the later Tertiaries of this region and in the Nucula beds (Eocene), Naparima, Trinidad, Guppy (190). No. 107149, U.S.N.M. Mr. Guppy compares the fragments found with *D. striatum*, Sowerby, of the English Eocene.

CADULUS PARIANUS, Guppy, new species.

(Plate XXX, fig. 7.)

Tube round, tapering, suddenly constricted near the broader end. Lon. 3, diam. 0.75 mm. [G.]

Ditrupa bed, Pointapier, Trinidad, Guppy (2277). No. 107155, U.S.N.M.

The name *Ditrupa*, which has been applied to this genus by Mr. Guppy, is now generally used for an annelid. These shells, though very similar to those of *Ditrupa*, are unquestionably molluscan and belong to the genus *Cadulus* of Philippi. It is stated by Mr. Guppy that the nearest relative of this species is the *C. dentalina* of the Jamaican Oligocene.

LIMOPSIS SUBANGULARIS, Guppy, new species.

(Plate XXX, fig. 2.)

Suborbicular, equivalve, subequilateral, closed; radiately and concentrically striate, with a slight angle at the hinder margin of the almost straight hinge line; radiating riblets regular, somewhat stronger on the slopes, narrower than the interstices; concentric ribs low and rounded, scarcely rising upon the radiating riblets; hinge teeth stout, scarcely curved, about 3 before and 3 behind the small cartilage pit. Height of valve, 6.75 mm. [G.]

Ditrupa bed, Pointapier, Trinidad, Guppy (2117). No. 107152, U.S.N.M. The specimens are very young, and perhaps have not fully assumed their adult characteristics.

ANOMIA UMBONATA, Guppy, new species.

(Plate XXX, fig. 6.)

Angularly and rather irregularly suboval; minutely shagreened, especially on the prominent umbonal region; umbo terminating in a sharp point. Breadth, 6 mm. [G.]

Shell bed, Ally Creek, Naparima, Trinidad, Guppy (2116). No. 107154, U.S.N.M. The imperfect state of the specimens precludes a more complete description.

ANOMIA SIMPLEX, Orbigny.

A. simplex, ORBIGNY, Moll. Cuba, II, p. 367, pl. XXVIII, figs. 31–33, 1853.

Recent from Cape Cod to Rio Janeiro, Brazil. Oligocene of Jamaica, Vendryes (Guppy, 2303). No. 107107, U.S.N.M.

Genus CRASSATELLITES, Kruger.

Subgenus CRASSINELLA, Guppy.

Crassinella, GUPPY, Geol. Mag., Decade II, Vol. II, Jan., 1875, not of BAYLE, 1879.
Gouldia, auct. var., not of C. B. ADAMS, 1847, nor of BONAPARTE (Aves), 1850.
Eriphyla, DALL, Proc. Zool. Soc. 1879, p. 132, not of GABB.
Pseuderiphyla, FISCHER, Man. Conch., p. 1022, 1887.

Having failed so far to find the place where the supposed genus *Crassinella* of Conrad is printed, it becomes probable that it is a manuscript name. At all events, unless somebody can find it, it should not be allowed to stop the way. Gabb's *Eriphyla* proves to have an external ligament like Meek's *Eriphylopsis*. Therefore, unless *Crassinella*, Conrad, can be located, Mr. Guppy's name for this little group of diminutive Crassatellas should take precedence, the name of Fischer having been suggested in the belief that Conrad's name had been published and was prior.

CRASSATELLITES (CRASSINELLA) GUPPYI, Dall, new species.

(Plate XXX, fig. 5.)

Rounded trigonal, flattish, concentrically costate, with 10 to 12 lamellar ribs, much narrower than the interstices. Alt. 4.6, lon. 4.6 mm.

Oligocene of Jamaica, Vendryes, and others (Guppy, 191). No. 107151, U.S.N.M. This species is related to the Recent and Neocene *C. martinicensis* and *guadelupensis* of Orbigny, but is constantly smaller. It was sent by Mr. Guppy under the manuscript name of *C. miocenica*, but as we now know that the horizon is Oligocene, I have taken the liberty of substituting Mr. Guppy's name for the name he proposed.

LUCINA PAUPERATA, Guppy, new species.

(Plate XXX, fig. 3.)

Suborbicular, not very convex, with faint, broad, radiating (ray-like) grooves and sublamellar concentric ridges. Diameter, 11.5 mm. The radiating ornament looks like color, but it is really faint, shallow flutings. Near to *L. squamosa*, Lam. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2297). No. 107101, U.S.N.M.

LUCINA TEXTILIS, Guppy, new species.

(Plate XXX, fig. 1.)

Orbicular, occasionally a little irregular in outline; decussate by somewhat irregular fine radiating and concentric lines; margins dentate. Diameter, 11 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2298). No. 107103, U.S.N.M. Resembles a small form of *L. costata*, Conrad.

DIVARICELLA PREVARICATA, Guppy, new species.

(Plate XXX, fig. 4.)

Suborbicular, inflated, margins minutely denticulate, surface divaricately sculptured. Length of shell, 8 mm. [G.]

Oligocene of Jamaica, Vendryes (Guppy, 2299). No. 107102, U.S.N.M. Resembles *D. americana*, C. B. Adams (=*quadrisulcata*, Orbigny), but is constantly smaller and weaker.

CARDIUM SERRATUM, Linnæus.

Oligocene of Jamaica, Vendryes (Guppy, 2300). No. 107104, U.S.N.M. This small form is identical with the dwarfed form from deep water (100 fathoms), which I named variety *sybariticum*.[1] The larger form is also found in the Bowden beds.

CLEMENTIA ? TÆNIOSA, Guppy, new species.

(Plate XXX, fig. 8.)

Subtriangularly suborbicular, scarcely ventricose, concentrically ribbed, the ribs rounded with concave sulci between them. Alt. 43, lon. 47 mm. [G.]

Tertiary beds of Savaneta, Trinidad (Guppy, 2302). No. 107106, U.S.N.M. The specimen is an internal cast, with the hinge line defective.

SANGUINOLARIA UNIOIDES, Guppy, new species.

(Plate XXX, fig. 11.)

Ovate oblong, slightly ventricose, smooth, with shallow, concentric sulci and fine radiating striæ. Length 63, height 44 mm. [G.]

Tertiary beds, Savana Grande, Trinidad, Guppy (2302). No. 107106, U.S.N.M. A somewhat Unio-like shell of uncertain affinities. The beds from which it came have yielded some other large bivalves whose affinities have not been ascertained, partly on account of their imperfect condition. [G.]

CORBULA DISPARILIS, Orbigny.

Corbula disparilis, ORBIGNY, Moll. Cuba, II, 283, pl. XXVII, figs. 1–4, 1846.
C. philippii, E. A SMITH, Chall. Rep., p 33, pl. VII, fig. 4, 1885.
C. operculata, PHILIPPI, Zeitschr. Mal., V, p. 13, 1849.

Oligocene of Jamaica (Guppy, 2295), and also recent in the Antilles.

TEREDINA ?, doubtful species.

Almost globular, anterior area finely closely laminose, posterior area subequal, nearly smooth, the medial groove feebly marked; callum

[1] Bull. Mus. Comp. Zool., XII, p. 271, 1886.

apparently complete, siphonal end slightly gaping, truncate, the margins thickened and reflected, the dorsal plates wanting, probably lost. Alt., 6 mm.

Oligocene of Jamaica, Vendryes (Guppy, 2296). No. 107100, U.S.N.M. This very singular little pholad is unfortunately imperfect, rendering it advisable to await more material before describing it. It was received with the manuscript name of *Martesia spharoidalis*, but it is not a *Martesia* and perhaps may prove a *Teredina*.

DIMYA GRANDIS, Dall, new species.

Shell large for the genus, ostreiform, attached by the right valve; externally smooth or (in the variety *divaricata*) rather strongly sculptured with close-set dichotomous radiating ribs; internally smooth and nacreous near the edges; the visceral area with a porcellanous, finely granulated coat, posterior adductor leaving a duplex scar, as in *D. argentea*, Dall; anterior scar single, small, close to the pallial border and high up in the valve; pallial area bordered by a line of minute, fringe-like, short grooves; cardinal crura raised on each side of the small, subtriangular socket for the resilium, behind which they join, forming in the right valve a keystone-shaped projection which fits inside the pair on the left valve. Alt. 32, lat. 30 mm.

Oligocene of the Potrero, Rio Amina, Santo Domingo, Bland. No. 113799, U.S.N.M.

The genus *Dimyodon*, Munier Chalmas, is characterized chiefly by its undivided posterior adductor scar, the tooth-like crura being present though feeble in the typical *Dimya*. The present form has the scars of *Dimya* and well-developed crura. From the recent *D. argentea* it is distinguished by sculpture, size, and hinge.

The differences of sculpture do not appear to be due to the object upon which the shell attaches itself, as this attachment is only by a very small portion of the surface.

Mr. Guppy's work was done largely without the advantages of books and specimens for reference, hence it naturally followed that his names in some cases require revision. With his types for comparison I have been able to correct some of these misidentifications, and the present occasion seems a proper one for putting the corrections on record, with notes on some other species:

Columbella ambigua and *C. gradata*, Guppy, are referable to the genus *Strombina*.

Columbella peculiaris, Guppy, is an *Æsopus*, nearly related to *Æ. stearnsii*, Tryon.

Scala (*Acrilla*) *leroyi*, Guppy, has also been collected on the Isthmus, near Gatun.

Clea truncata, Guppy, is a *Planaxis* which Mr. Guppy wrongly identified with *Etrachelizia truncata*, Gabb. Although Mr. Guppy[1] figures the genuine shell, his specimens are quite different.

[1] Journ. Geol. Soc., XXXII, pl. xxix, fig. 6.

Dolophanes melanoides, Gabb, is identical with *Crepitacella cepula* as claimed by Mr. Guppy, and the latter name has priority.

Iopsis, Gabb, was founded on an immature *Rissoina*, as his type specimen shows.

Actæonidea, Gabb, is synonymous with *Rictaxis*, Dall, which has two or three years priority.

I have discussed *Orthaulax*, Gabb, in the Transactions of the Wagner Free Institute of Science, Vol. III. The *Petaloconchus* of Mr. Guppy's list is not *P. sculpturatus*, Lea, and should retain Sowerby's name of *domingensis*.

Turbonilla subcarinata, Orbigny, of Guppy's list, is an immature *Rissoina*, from Matura, Trinidad.

Amauropsis ocalanus, Dall, from the Lower Oligocene of Florida, has also been detected in Santo Domingo on the Rio Amina.

Gryphæa athyroides, Guppy, has the aspect of an *Ostrea*, but the hinge is inaccessible.

Cercomya ledæformis, Guppy, is a *Leda* and, under the circumstances, may better be renamed *Leda guppyi*.

Crassatella, labeled *marylandica*, Conrad, from the Oligocene of Jamaica, is not that species, nor *C. floridana*, Dall, but probably an undescribed species.

Dosinia cyclica, Guppy, is a *Lucinopsis*.

Corbula rieta, Guppy, was founded on the sculptured valves of *C. disparilis*, Orbigny; *Erycina tensa*, Guppy, upon the smooth valves of the same species.

Tellina, identified with *T. biplicata*, Conrad, appears distinct, and should retain d'Orbigny's specific name of *sagræ*. It belongs to the subgenus *Metis*, H. and A. Adams.

The following Polyzoa were included from the Jamaican Oligocene and identified by Mr. Guppy:

CUPULARIA OWENI, Lamarck.

MEMBRANIPORA SAVARTI, Audouin.

There are several undetermined species of Polyzoa in the Ditrupa beds of Pointapier, Trinidad.

It may not be amiss to remark that *Orbitoides mantelli* has been repeatedly and persistently reported from the Tertiaries of the West Indies; but in no case which I have been able to examine has the West Indian species proved to be the true *O. mantelli*. The most southern locality for the genuine *O. mantelli* is in the Guallava sandstones of Costa Rica, though the species doubtless occurs on the northwestern shores of Cuba. The West Indian form sent under the name of *O. mantelli* has been identified as *O. forbesii*, a much thicker, more globose, and smaller species.

EXPLANATION OF THE PLATES.[1]

PLATE XXVII.

FIG. 1. *Clathurella vendryesiana*, Dall; alt., 14 mm.; p. 306.
2. *Dillwynella errata*, Guppy; alt., 1.5 mm.; p. 323.
3. *Solariorbis clypeatus*, Guppy; lat., 3 mm.; p. 323.
4. *Mangilia consentanea*, Guppy; alt., 6.2 mm.; p. 307.
5. *Cythara guppyi*, Dall; alt., 6.5 mm.; p. 306.
6. *Cythara mucronata*, Guppy; alt., 5.5 mm.; p. 306.
7. *Cythara obtusa*, Guppy; alt., 5.7 mm.; p. 306.
8. *Stylopsis octona*, Guppy; alt., 1.25 mm.; p. 317.
9. *Cythara gibba*, Guppy; alt., 3.8 mm.; p. 306.
10. *Benthonella turbinata*, Guppy; alt., 1 mm.; p. 321.
11. *Aclis* (*Amblyspira*) *prominens*, Guppy; alt., 4 mm.; p. 314.
12. *Clathurella amicta*, Guppy; alt., 4.6 mm.; p. 305.
13. *Liotia verecimilis*, Guppy; alt., 1.5 mm.; p. 324.
14. *Carinaria caperata*, Guppy; 7 mm.; p. 318.
15. *Hipponyx tortilis*, Guppy; lon., 6.5 mm.; p. 322.
16. *Fossarus* (*Gottoina*) *mundulus*, Guppy; alt., 3 mm.; p. 320.
17. *Solariella altiuscula*, Guppy; lat., 7 mm.; p. 324.
18. *Liotia siderea*, Guppy; alt., 3.5 mm.; p. 324.

PLATE XXVIII.

FIG. 1. *Turbonilla simplicior*, Guppy; alt., 7.5 mm.; p. 317.
2. *Bittium* (*Styliferina*) *præformatum*, Guppy; alt., 5.5 mm.; p. 318.
3. *Turritella arata*, Guppy; alt., 10.3 mm.; p. 319.
4. *Turbonilla plastica*, Guppy; alt., 3.5 mm.; p. 316.
5. *Turbonilla turritissima*, Guppy; alt., 6.75 mm.; p. 316.
6. *Aclis* (*Amblyspira*) *teres*, Guppy; alt., 2 mm.; p. 314.
7. *Alaba turrita*, Guppy; alt., 5 mm.; p. 321.
8. *Turbonilla tenuilineata*, Guppy; alt., 5 mm.; p. 317.
9. *Aclis acuminata*, Guppy; alt., 3 mm.; p. 313.
10. *Turbonilla angulata*, Guppy; alt., 3.5 mm.; p. 316.
11. *Eulima egregia*, Guppy; alt., 29 mm.; p. 314.
12. *Phos* (*Strongylocera*) *fasciolatus*, Dall; alt., 24 mm.; p. 311.
13. *Pyramidella* (*Longchæus*) *forulata*, Guppy; alt., 5 mm.; p. 315.
14. *Oscilla indiscreta*, Guppy; alt., 6 mm.; p. 317.
15. *Phos metuloides*, Dall; alt., 20 mm.; p. 310.

PLATE XXIX.

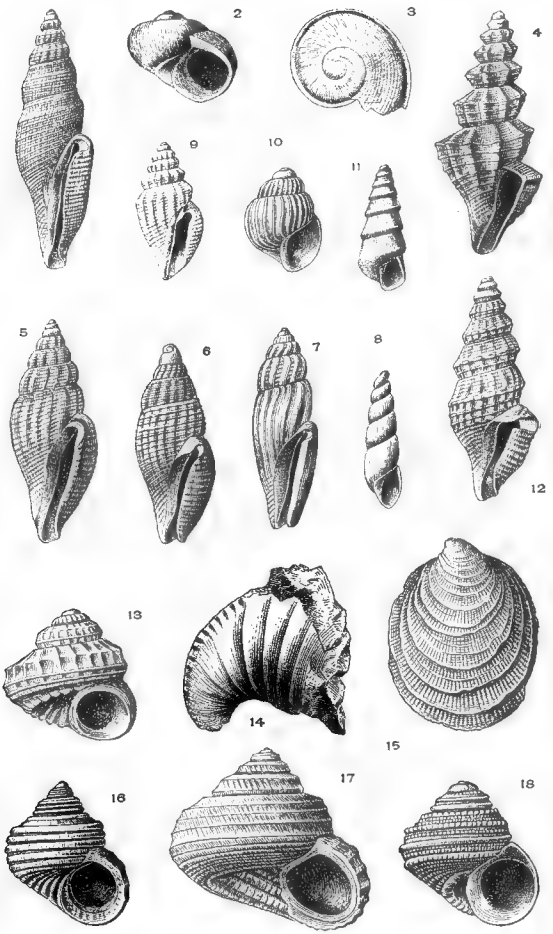
FIG. 1. *Cancellaria rowelli*, Dall; alt., 25 mm.; p. 307.
2. *Ultimus precursor*, Dall; lon., 24.5 mm.; p. 318.
3. The same in profile.
4. *Phos gabbii*, Dall; alt., 24 mm.; p. 310.
5. *Mathilda plexita*, Dall; alt., 18.3 mm.; p. 320.
6. *Strombinella acuformis*, Dall; alt., 13.5 mm.; p. 312.
7. *Strombina mira*, Dall; alt., 9 mm.; p. 312.
8. ? *Pyrazisinus haitensis*, Dall; alt., 35 mm.; p. 319.
9. *Rissoa pariana*, Guppy; alt., 2.3 mm.; p. 321.
10. *Pyramidella* (*Longchæus*) *jamaicensis*, Dall; alt., 3.25 mm.; p. 315.

[1]As the figures are not drawn to a uniform scale, the greatest length, altitude, or breadth of the specimen in millimeters follows the reference in each case.

FIG. 11. *Marginella latissima*, Dall; alt., 11 mm.; p. 308.
12. *Marginella limonensis*, Dall; alt., 30 mm.; p. 309.
13. *Marginella arcuata*, Guppy; alt., 4.5 mm.; p. 308.
14. *Marginella solitaria*, Guppy; alt., 3 mm.; p. 308.
15. *Marginella amina*, Dall; alt., 25 mm.; p. 309.

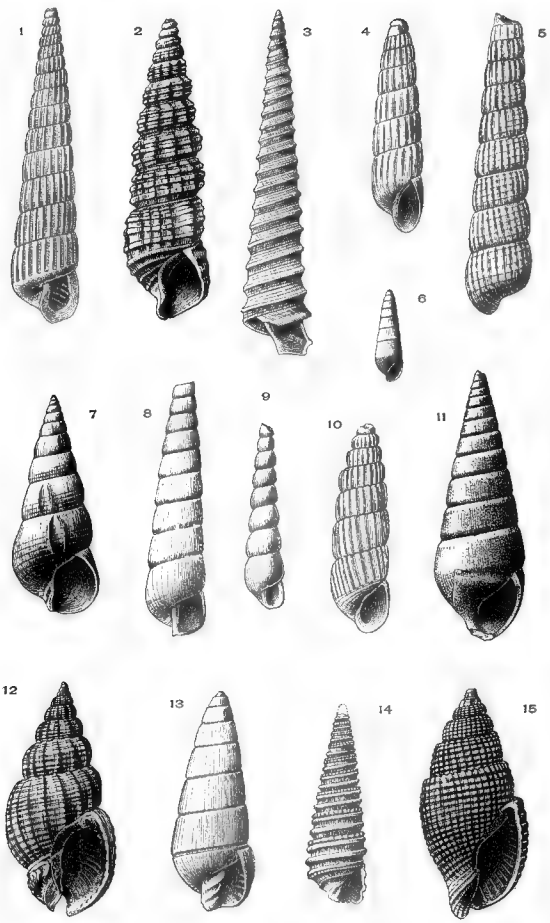
PLATE XXX.

FIG. 1. *Lucina textilis*, Guppy; lon., 11 mm.; p. 326.
2. *Limopsis subangularis*, Guppy; lon., 6.75 mm.; p. 325.
3. *Lucina pauperata*, Guppy; lon., 11.5 mm.; p. 326.
4. *Divaricella prevaricata*, Guppy; lon., 8 mm.; p. 327.
5. *Crassinella guppyi*, Dall; lon., 4.6 mm.; p. 326.
6. *Anomia umbonata*, Guppy; lon,, 6 mm.; p. 325.
7. *Cadulus parianus*, Guppy; lon., 3 mm.; p. 325.
8. † *Clementia tæniosa*, Guppy; lon., 47 mm.; p. 327.
9. *Eulima* (*Liostraca*) *nobilis*, Guppy; alt., 7 mm.; p. 315.
10. *Olivella indivisa*, Guppy; alt., 6.5 mm.; p. 308.
11. *Sanguinolaria unioides*, Guppy; lon., 63 mm.; p. 327.
12. *Oliva plicata*, Guppy; alt., 12.2 mm.; p. 308.



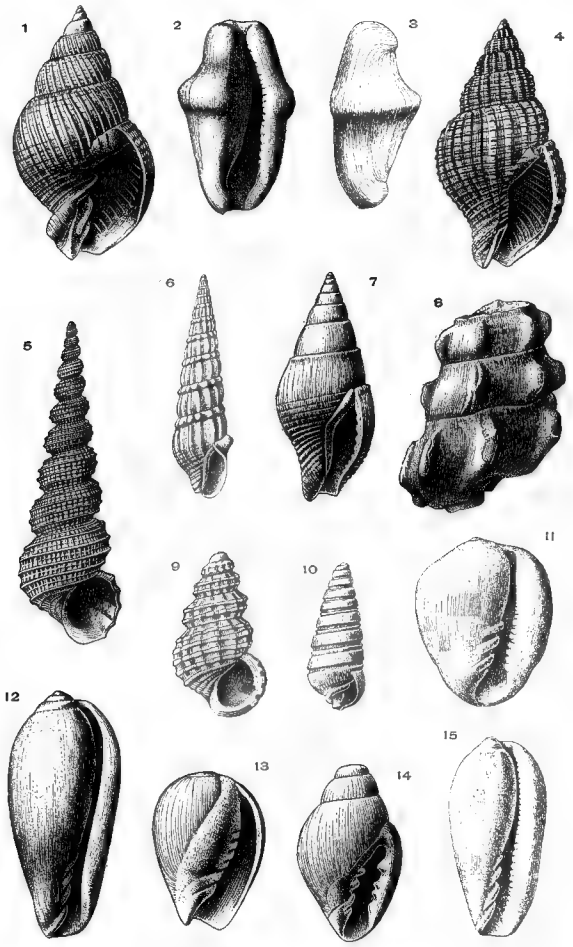
ANTILLEAN TERTIARY FOSSILS.

FOR EXPLANATION OF PLATE SEE PAGE 330.



ANTILLEAN TERTIARY FOSSILS.

FOR EXPLANATION OF PLATE SEE PAGE 330.



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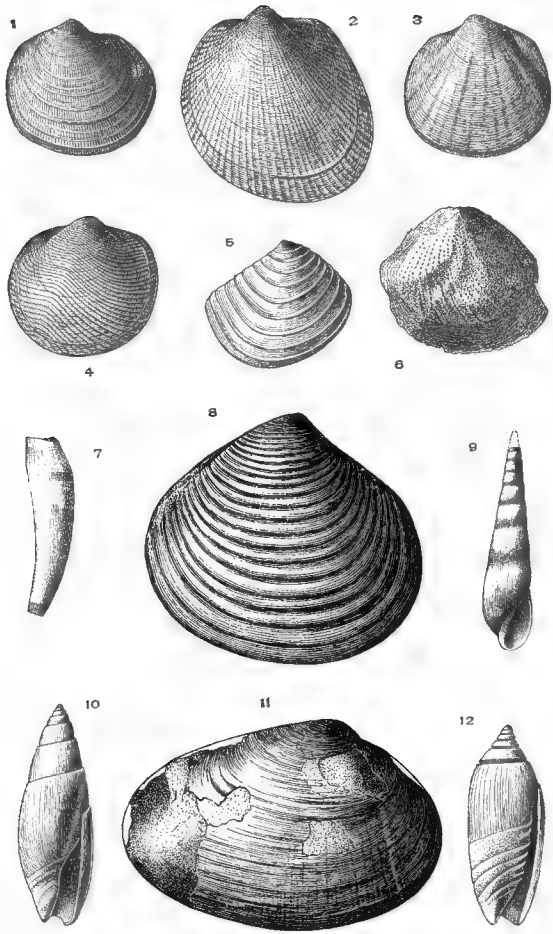
FOR EXPLANATION OF PLATE SEE PAGE 330.



ANTILLEAN TERTIARY FOSSILS.

FOR EXPLANATION OF PLATE SEE PAGE 331.

REPORT ON THE MOLLUSKS COLLECTED BY THE INTERNATIONAL BOUNDARY COMMISSION OF THE UNITED STATES AND MEXICO, 1892–1894.

By WILLIAM HEALEY DALL,
Honorary Curator of the Department of Mollusks.

Introductory remarks.—In the report of the first Mexican Boundary Survey, with Captain (afterwards General) W. H. Emory, U. S. Army, in command, no account appears of mollusks collected. Much space is given to the vertebrates, botany, and geology, and admirable illustrations adorn the several reports, but it is probable that no great number of mollusks was collected and the specimens obtained were overlooked or scattered.

It has long been known that the region north of Mexico, between the Rio Grande and the Colorado, is faunally distinct from the region of the Atlantic drainage, as well as from the fauna of the Pacific Coast. It has been named as a faunal region by several students of geographical distribution, and among students of mollusks has been usually termed the Central or Sonoran faunal region. So far as these animals are concerned, it seems rather a prolongation northward of the fauna of the mountains of northern Mexico than a southern extension of that of the Great Basin west of the Rocky Mountains. It presents features due to contributions from the Californian and Mexican regions, the latter predominating, with a few stragglers from the North. Seldom visited, arid, and inhospitable to molluscan life, the data relating to its fauna are widely scattered and mingled with those which concern those of other parts of the western country. It may, therefore, be useful to recall the names of those to whom, in the past, we have been indebted for collections made in the region, and to give a brief notice of the principal sources of information in the literature.

Some of the first shells described from this region formed part of a collection made by Berlandier, and were sold by him to Lieutenant (afterwards General) D. N. Couch, U. S. Army, of the original boundary survey, who generously presented them to the Smithsonian Institution. These were named by Dr. Isaac Lea in 1857, but appear to belong to the relatively low-lying region east of the Sierra Madre in the States of

Nuevo Leon and Tamaulipas. After the survey of the boundary came the surveys for a route for a Pacific railway, in which a number of the same officers were employed. By them and by other members of the parties engaged, a few mollusks were collected, including several fossil forms from the Colorado desert. Dr. John L. Le Conte and Prof. William P. Blake were among the contributors, and the mollusks were reported on by T. A. Conrad and Dr. A. A. Gould.

At a later date naturalists settled in California, and either directly or through the aid of collectors, obtained a few species from the borders of this region, which were described by Newcomb, Cooper, Yates, and others. After the establishment of the State geological survey contributions collected in Sonora were received from August Rémond, and from Lower California, collected by W. M. Gabb. Dr. Horn, of the Army, sent some interesting species from Fort Grant, Arizona, to Gabb, which were described by the latter. Under the auspices of the Smithsonian Institution collections were made in the vicinity of the boundary, by Dr. Edward Palmer. Later still, parties connected with the Department of Agriculture and the United States Geological Survey worked in the same region and a few species were added to the list of those known through explorations by Dr. A. K. Fisher, Vernon Bailey, Mr. Lloyd, Dr. C. Hart Merriam, E. W. Nelson, and others, most of which were reported on by Dr. R. E. C. Stearns.

Collections made by the French in Mexico form the basis of a sumptuous report by Messrs. Crosse and Fischer, who treat of the whole land and fresh-water fauna of the Republic in a manner which renders their work indispensable to all students of the subject.

A valuable and little known report on Mexican land shells was issued in Hamburg by Herr Hermann Strebel, assisted by Dr. G. Pfeffer, and should be consulted by anyone who is investigating this fauna.

In the important series of monographs by Messrs. Godman and Salvin on the biology of Central America, the mollusks are described by Dr. E. von Martens, and those parts which have appeared are of that masterly character which the reputation of that author has long led us to expect.

Latest of all, and practically simultaneously with the work of the Boundary Commission on which the present paper is based, may be mentioned explorations set on foot by the California Academy of Sciences in northwestern Mexico and the peninsula of Lower California, during which interesting collections were made by Messrs. Eisen, Bryant, Vaslit, and others, which have been reported on by Dr. J. G. Cooper and partly discussed by the writer.

The material collected belongs to three different faunal regions of very different degrees of interest, and each will be discussed separately. These are: (1) the Central or Sonoran region, extending from the Rio Grande of Texas to the Colorado River of Arizona, and on both sides

of the boundary line which divides the two; (2) the Texan region, to the east of the Rio Grande and south to the Gulf of Mexico; the fauna of this region is hardly to be discriminated from that of the State of Tamaulipas, west of the river, but in which no collections were made by the Commission; (3) lastly, west of the Colorado River in Southern California, the Californian coast fauna is encountered, and collections were made, not only on the mainland, but also on San Clemente Island, some 60 miles off the coast.

THE SPECIES OF THE CENTRAL OR SONORAN REGION.

The following species were received from Dr. Edgar A. Mearns, U. S. Army, from localities on either side of the international boundary line between the Rio Grande River, near El Paso, Texas, and the Colorado River of the West, near Yuma, Arizona.

The plains are almost uniformly arid and frequently alkaline, forming what was formerly called desert, and quite unfit for the subsistence of land snails. It will be understood that nearly all of the Pulmonates were collected from the upper levels of the various mountain ranges near the boundary, which rise from the plains into a region of moister air, which, though still dry, supports a certain amount of vegetation. Most of the snails are found dead on the surface of the soil; only when infrequent rains occur do the live animals venture from the nooks and crannies where they usually æstivate out of reach of the collector. Consequently good opportunities for collecting are rare and fresh specimens in a small minority. Even when fresh, many of them have the well-known texture characteristic of dwellers in arid regions, such as Arabia and the Sahara.

LAND SHELLS.

Family ENDODONTIDÆ.

Genus PYRAMIDULA, Fitzinger.

Subgenus PATULA, Held.

PATULA STRIGOSA, Gould.

Typical specimens of this species were obtained at San Jose Mountain, Sonora, Mexico; from Hachita Grande Mountain, Grant County, New Mexico, and from the summits of the Huachuca Mountains, Arizona, by Dr. Mearns and Mr. Holzner. A sharply carinated variety was collected at Tanners Canyon, Huachuca Mountains, Arizona, by Dr. Mearns.

The normal form, very variable in coloration, has a somewhat dome-shaped but low spire, appressed suture, and 5 whorls. It measures 19 in minor, 25 in major diameter, with a height of 13 mm. The carinate variety has a sharp peripheral keel, but is otherwise similar.

PATULA STRIGOSA var. CONCENTRATA, Dall.

Patula strigosa var. *conventrata*, DALL, Proc. U. S. Nat. Mus., XVIII, p. 1, 1895.

A variety, which exactly mimics the normal form above mentioned, has the same number of whorls, but measures only 13 mm. in minor and 16 in major diameter, with a height of 8 mm. Its coloration, when not bleached, is usually a dark-brown band above and below and a white periphery. It was found in some numbers on the summits of Hachita and the Huachuca Mountains, and preserves a marked uniformity, which would seem to entitle it to a varietal name.

Type.—No. 129999, U.S.N.M. Also on the Jemez Mountains, Ashmun.

The peculiarly arid climate, with irregular rainfall, which characterizes the region where these snails are found, is probably responsible for the viviparity which distinguishes them from the *Patulæ* of moister regions. The young shells exist in the oviduct of the parent, in numbers from 4 to 8, and reach a development of more than 2 whorls and a diameter of nearly 5 mm. before extrusion. When born they are quite able to take care of themselves, and can if necessary form a protective epiphragm at once. The soft-shelled eggs laid by the eastern species of *Patula* would doubtless dry up completely in an hour or two in the dry atmosphere of Arizona.

Family HELICIDÆ.

Genus THYSANOPHORA, Strebel and Pfeffer.

THYSANOPHORA HORNII, Gabb.

A single dead specimen (No. 130001, U.S.N.M.) was sent in by Dr. Mearns, collected at the summit of the Hachita Grande Mountain, Grant County, New Mexico. The species was originally described from the vicinity of Fort Grant, Arizona, and is a characteristic species of the region. I have seen it from the drift of the Yaqui River, Mexico. When fresh it is translucent, dark brownish, the periostracum with oblique raised spiny lamellæ inclined at an angle to the incremental lines. This coating seems to have a certain sticky quality, so that grains of dirt adhere to it with such persistency that the shell can not be cleaned without destroying the periostracum. Dead specimens are rather solid, coarsely striated, and chalky-looking, hardly to be recognized as the same thing.

It occurs by some oversight in Pilsbry's revision of the Helices in the lists under both *Pyramidula* and *Thysanophora*. Without a knowledge of the anatomy its proper place can not be determined, but the aspect of the shell is more like some of the *Thysanophoræ* than *Pyramidula*.

Genus EPIPHRAGMOPHORA,[1] Döring.

EPIPHRAGMOPHORA ARIZONENSIS, Dall.

(Plate XXXI, figs. 11, 12.)

Epiphragmophora arizonensis, DALL, Proc. U. S. Nat. Mus., XVIII, p. 1, 1895.

Shell small for the genus, moderately elevated, light colored, with a narrow brown band just above the periphery, mostly concealed by the suture, but on the outer side visible within the aperture; whorls 4½, of which 1½ are nepionic and punctate, the remainder with rather well-marked incremental lines and microscopic vermicular markings, of which the longer axes are subparallel to the lines of growth; suture distinct; whorls full and rounded, but with the periphery slightly above the middle; the last whorl descending a little, near the aperture; base rounded; umbilicus narrow but deep; aperture expanded, the pillar lip reflected, but the outer lip not so; body with a slight wash of callus between the lips; height of shell 11, major diameter 17, minor diameter 13.5 mm.

A single specimen from the banks of the Santa Cruz River, Tucson, Arizona, Dr. Mearns (No. 130002, U.S.N.M.).

The type specimen is somewhat bleached, but otherwise in good condition, and is almost the smallest of the group with which it is associated and of which *E. traskii*, Newcomb, is an exemplar. It agrees with none of the species in detail, in general resembling most some small shells which in the National Museum are labelled as a dwarf race of *E. traskii*. *Arionta* var. *indioensis*, Yates, is very similar, but larger, with a more oval aperture and wider umbilicus, and the brown line is not covered by the suture. The species of this group are greatly in need of careful revision. Among those belonging to the peninsular or Sonoran faunæ several species have been confused or contested. Thus *E. carpenteri*, Newcomb, a depressed spirally striated shell has been generally united in synonymy with *Leptarionta remondi*, Tryon. The latter was described from specimens obtained by M. Rémond at Mazatlan, but which probably came from the peninsula of Lower California across the Gulf of California from Mazatlan. At least the Mexican habitat has not been confirmed by subsequent collectors. Gabb obtained it in the mountains of the peninsula near Trinidad and Muleje. One of Mr. Tryon's types is now before me agreeing perfectly with his description and showing the microscopic pustules which in perfect specimens probably support hairs. It has no spiral striæ, and is a smaller and more elevated shell than *E. carpenteri*. It has been renamed *L. verrillii* by Ancey,[2] probably because he had received specimens of *E. carpenteri* under the erroneous name of *remondi*. Since *Polygyra*

[1] *Arionta* of American authors, not of LEACH.

[2] Conch. Exchange, II, p. 63, Nov., 1887.

carpenteriana, Bland, belongs to a different group, Newcomb's name may properly stand, even if we admit the principle propounded by Crosse and Fischer to the effect that two species of one genus can not be named for the same person, a claim which rests upon no established rule, and is in fact in conflict with usage.

Two forms have been distributed or are found in collections under the name of *H. carpenteri*, Newcomb. Unfortunately the original type of Dr. Newcomb, which was a bleached shell obtained from Frick (whose localities are known to be often suspicious) with the erroneous locality, "Tulare Valley," is no longer to be found in his collection, the doctor having perhaps replaced it by what he considered better specimens of the same species. The exact measurements of his original do not agree with those of any specimen received from Dr. Newcomb or otherwise under the name *carpenteri*. It is probable that the printed height of the shell (16.5 mm.) is a misprint or a mismeasurement for 14.5 mm. Apart from this we learn from the diagnosis that the type was distinctly spirally striated and had 5½ whorls. Now, one of the forms circulated under the name *carpenteri* has very distinct striation and the right number of whorls and diameter, and comes from the vicinity of San Diego, California, and especially from the Coronado Islands which are near San Diego off the coast. It is this which Mr. W. G. Binney received from Dr. Newcomb as *H. carpenteri* and has regarded as entitled to the name. In this view I agree, but suspect the shell to be a local race of *H. traskii*, Newcomb, which is somewhat more elevated and with fainter spiral striæ. The other shell, which has been known as *carpenteri*, comes from Trinidad, Lower California, and near Mazatlan, State of Sinaloa, on the Mexican mainland, where it was collected by Gabb. It has only 4 to 5½ whorls and is paler, with a thinner epidermis and few traces of striation. It is probably a distinct species.

Another species which has been contested is *H. lohrii*, Gabb, which is a depressed shell with a curious ovately rounded, widely expanded peristome, behind which the whorl is smaller though not abruptly constricted. One of Gabb's types has a maximum diameter of 22, a minimum diameter of 16.5, and a height of 10 mm.

The surface of the spire is almost flat, the periphery is formed by an almost angular shoulder high up on the whorl, and the umbilicus is scalar, revealing the whorls to the apex.

Through the courtesy of Prof. G. D. Harris, of Cornell University, and the authorities of the University, I have had an opportunity of comparing with typical specimens of *H. lohrii*, received from Gabb, the original types of *H. roweelli*, Newcomb, preserved in the Newcomb collection, now the property of the university. Gabb's species have very generally been referred to *H. roweelli* as a synonym, and they are very closely related. One of Dr. Newcomb's specimens, and perhaps two of them, belong to another species, *H. magdalenensis*, Stearns, but the more perfect ones upon which his description was founded are closely

related to *H. lohrii*, from which they differ by having a more elevated spire and the last whorl evenly rounded, instead of shouldered and subangular, and the shell is smaller, measuring 19 in major and 14.5 in minor diameter, and 9 mm. in height. The number of whorls, the aperture, nucleus, and umbilicus do not differ to any important extent in the two forms. It is probable, as originally stated by Newcomb, that his types came from Arizona, since the associated *H. magdalenensis* is not known from Lower California, and that, as in so many other cases, the specific form represented by *H. lohrii* has a large and a small race, fairly constant in their several localities, but connected by occasional intermediate specimens. As the oldest name is that of Newcomb, this should be kept for the species, while Gabb's name may be preserved for the larger and depressed peninsular race in a subspecific sense. Both are distinguished from *H. magdalenensis* and its allies by the wider umbilicus and by the wide reflexed lip, the peristome in the last-mentioned group being somewhat expanded and slightly thickened, but not forming a reflected lip, properly speaking.

EPIPHRAGMOPHORA MAGDALENENSIS, Stearns.

Helix (Arionta) magdalenensis, STEARNS, Proc. U. S. Nat. Mus., XIII, p. 207, pl. XV, figs. 7, 11, 13 (not 12), 1890.

Found by V. Bailey on top of a mountain 1,000 feet above Magdalena, Sonora, Mexico, among rocks; also by Dr. Fisher and Mr. E. W. Nelson, in Johnson Canyon, near the Panamint Valley, California, at an altitude of 6,000 feet; and by Vernon Bailey near Resting Springs, California, among rocks on a dry hill 900 feet above the springs, during the Death Valley expedition. A form (No. 130003, U.S.N.M.) which may be a dwarf of the next species or a variety of the present one was collected on San Jose Mountain, Sonora, Mexico, near the boundary line, by Dr. Mearns.

This species as originally described is small and depressed, having when fresh a translucent, polished dark-brown color, with a pale chestnut-brown line above the shoulder. The fact that dwarf specimens occur rather frequently with nearly all the species of this group renders it difficult to distinguish the normally small species from the small individuals of similar larger species. All the species being more or less variable in form and surface texture, the group is one which presents unusual difficulties to the student.

EPIPHRAGMOPHORA HACHITANA, Dall.

(Plate XXXI, figs. 7, 10.)

Epiphragmophora hachitana, DALL, Proc. U. S. Nat. Mus., XVIII, p. 2, 1895.

Shell large, depressed, polished, sculptured with irregularly prominent incremental lines, but without spiral striation or surface granulation; with 4½ rounded whorls; suture distinct; last whorl near the

peristome depressed; aperture oblique, with a thickened and somewhat dilated but not reflected lip; pillar lip broad near the body, united to the outer lip over the body by a thin callus; umbilicus moderate, deep, exhibiting nearly 2 whorls; color of the fresh shell pale reddish purple or livid waxen, paler near the umbilicus, with a single purplish-brown band above the periphery, bordering the suture below it, with an ill-defined pale band on each side of it somewhat wider than the brown one; the latter is also visible inside the aperture; bleached specimens are waxen white with the brown band more or less faded; major diameter of largest shell 26.5, minor diameter 21, height 12 mm. An average specimen measures 23.5, 19, 12, and the smallest adult 21, 16.5, 10.5 for the same dimensions.

Fort Huachuca, Arizona, A. K. Fisher; Tucson, Arizona, Cox, in Lea collection; below San Quentin, Lower California, G. P. Merrill; Doubtful Canyon, Peloncello Mountains, southwest New Mexico, F. H. Fowler in United States National Museum; and by Dr. Mearns at the following localities: Top of Hachita Grande Mountain, altitude 8,270 feet, Grant County, New Mexico; near Carrizollilo Springs, New Mexico, on the top of two peaks near the boundary line; on Black Mountain, 12 miles south of boundary monument No. 77, in Northern Mexico; and in the Huachuca Mountains, Arizona, altitude 8,000 to 9,000 feet, by Dr. Mearns and F. X. Holzner.

Type.—No. 130004, U.S.N.M.

In specimens from Tanners Canyon, Huachuca Mountains, the shell was somewhat more depressed and the colors darker than from other localities.

This seems to be the most abundant of the mountain species, and its dwarfs seem most easily distinguished from the *E. magdalenensis* by their somewhat more inflated and higher form and their reddish tint when fresh. The fully developed specimens which comprise the great majority are very much larger than *E. magdalenensis*, but bleached and dead dwarf specimens can hardly be distinguished from full grown *magdalenensis* in a similar condition. The specimen figured is of the depressed variety from Tanners Canyon, Huachuca Mountains.

EPIPHRAGMOPHORA COLORADOËNSIS, Stearns.

Helix (*Arionta*) *coloradoënsis*, STEARNS, Proc. U. S. Nat. Mus., XIII, p. 206, pl. xv, figs. 6, 8, 12 (not fig. 7), 1890.

Grand Canyon of the Colorado River, Arizona, opposite the Kaibab plateau, at an elevation of 3,500 feet; Dr. C. Hart Merriam.

This species, though belonging to the same region, has so far been collected only at the type locality. It is closely related to *E. magdalenensis*, but seems separable. In the original paper by Stearns the two figures representing the upper surface of the spire were transposed, so that the references to them are erroneous and should be reversed, as a careful comparison of them with the text of the description would

show. The surface of the freshest specimens has a certain fuzziness, as if, when quite perfect, they would be microscopically hirsute.

Genus POLYGYRA, Say.

POLYGYRA LEVETTEI, Bland.

Triodopsis levettei, BLAND, Ann. N. Y. Acad. Sci., II, 1881, p. 115.—BINNEY, Bull. Mus. Comp. Zool., XI, No. 8, p. 154, pl. I, fig. E, Dec., 1883; Man. Am. Landsh., p. 385, fig. 419, 1885; Bull. Mus. Comp. Zool., XIII, No. 2, p. 36, pl. I, fig. 15, 1886.—TRYON, Man. Conch., 2d ser., III, p. 143, pl. XXIX, figs. 88, 89, 1887.—PILSBRY, Man. Conch., 2d ser., IX, p. 76, 1894.—ANCEY, Conch. Exch., II, p. 63, Nov., 1887.

Triodopsis levettei var. *thomsoniana*, ANCEY, Conch. Exch., II, p. 64, Nov., 1887.

Triodopsis levettei var. *orobæna*, ANCEY, Conch. Exch., II, p. 64, Nov., 1887.

Santa Fé Canyon, near Santa Fé, New Mexico, Dr. Levette, Thomson; near Tucson, Arizona, COX; Fort Huachuca, Arizona, Dr. Fisher; Huachuca Mountains, Arizona, near the summit of the higher peaks, Dr. Mearns. No. 130010, U.S.N.M.

This species is more of a *Polygyra* s. s. than a typical *Triodopsis*. It has the aspect of the former group, and only wants a V-shaped angle to the parietal tooth to satisfy the strict diagnosis. The form mentioned by Binney with a single basal tooth, rather bifid, as represented by his type in the national collection, is pathological and not a real variety. The whorls vary from 6 to 7, rarely less than 6¼. The varieties mentioned by Ancey are stated to have only 5½ whorls and one hardly bifid basal tooth; var. *orobæna*, Ancey, differs from *thomsoniana* only by having the aperture somewhat larger and less oblique. I have seen no specimens corresponding to Ancey's description; none of the specimens from any locality has so few as 5½ whorls.

The species belongs at high altitudes in the New Mexican region and seems to be extremely rare. The surface under magnification shows minute irregularities approximately in harmony with the lines of growth; the striation is feeble and the general appearance of fresh specimens is polished dark yellowish brown. The variety without teeth mentioned by Binney is a distinct species.

POLYGYRA CHIRICAHUANA, Dall.

(Plate XXXII, figs. 9, 10, 12.)

Polygyra chiricahuana, DALL, Proc. U. S. Nat. Mus., XVIII, p. 2, 1895.

Shell depressed, thin, polished, of a dark brownish color, 5½ whorls, sculptured only with fine incremental lines; suture distinct, the intervening whorls moderately rounded; periphery rounded, the termination of the last whorl constricted behind the lip and moderately descending; umbilicus deep, narrow, showing a small part of the penultimate whorl near the aperture; aperture oblique with a narrow, strongly reflected lip of a livid whitish color, the pillar and outer lips connected in fully

mature specimens by a smooth callus over the body; the outer lip is flexuous, receding near the periphery and more vertical at the base; the aperture is entirely destitute of teeth. Height 7.7, major diameter 18, minor diameter 14.8 mm.

Near Tucson, Arizona, Cox; Fly Park, Chiricahua Mountains, Arizona, at an elevation of 10,000 feet, Dr. Fisher, United States Department of Agriculture. No. 124481, U.S.N.M. Jemez Mountains, near Bland, New Mexico, and at Jemez Sulphur Springs, 8–10,000 feet above the sea, Ashmun.

This form has been mistaken for a variety of *P. lerettei* without teeth, but is clearly another species. An examination of over seventy-five specimens shows that none of them has a trace of lip teeth, and there are no specimens otherwise intermediate. As compared with *P. lerettei* the shell is uniformly larger and yet with 1 whorl less, but proportionally more depressed. The actual measurements of the largest specimen of *lerettei* I could find are: Height 7.7, major diameter 15.7, minor diameter 13 mm. The surface, color, etc., are very similar in both species. Numerous specimens show a resting stage at about the last half of the last whorl, where the shell has been thickened and shows a slight constriction, followed by an opaque space, which, however, seems never to have had a reflected lip.

A variety shows a small feeble parietal denticle, like that of *P. pseudodonta*, but the lip is not denticulate.

With this species Dr. Fisher collected *Vitrea arborea*, Say, *Thysanophora ingersollii*, Bland, and *Pyramidula striatella*, Anthony. The locality is in Cochise County near the southeastern angle of Arizona, close to the Mexican boundary line.

Mr. Binney has compared this species to *P. mullani*, Bland, and *P. kiowaënsis*, Simpson, but both these species are of the *Mesodon* type, and apparently not closely related either to *P. lerettei* or *P. chiricahuana*. Neither *Mullani* nor *Kiowaënsis* are known from the region in which alone, so far, the other two have been collected.

I have included this species here, as it belongs to the same faunal region, and is therefore naturally associated with the species collected by Dr. Mearns.

POLYGYRA ASHMUNI, Dall.

The Rev. E. H. Ashmun, of Albuquerque, New Mexico, has forwarded for examination some shells which appear to be fully adult and normal, and resemble extremely, in miniature, *Polygyra chiricahuana*. They differ from it in size, being only 14 mm. in greatest diameter and 7 mm. in height, and in the surface, which, when strongly magnified, is seen to be covered with sharp, delicate, spiral, incised lines, with wider interspaces. The number of whorls is but slightly less, if at all different from *P. chiricahuana*, and, if the element of actual size be ignored, the figure here given of the latter will equally well represent the present

shell. A careful scrutiny of a series of *P. chiricahuana* shows that occasional sparse, spiral, incised lines are found on some individuals, so that the present shell may only represent a dwarf race of it with more emphatic sculpture. However this may be, the difference is so great as to form at least a well-marked variety worthy of a name.

The types (No. 107610, U.S.N.M.) were collected at Bland, New Mexico, at an elevation of 8,000 feet above the sea. Mr. Ashmun notes that in coming down the mountains toward Bland, the typical *P. chiricahuana* was abruptly replaced by *P. ashmuni*.

POLYGYRA PSEUDODONTA, Dall.

Shell closely resembling *P. ashmuni* in form and size, but with the whorls slightly flattened above and below and of a yellowish straw color instead of livid brown, the spiral striation less sharp and largely obsolete. The aperture with a narrow reflected lip, pink or whitish, which has on the internal edge of the basal part a slight callosity which is divided by a narrow sulcus in the direction of the coil of the shell. Within the aperture and nearly midway between the outer and pillar lips is a small low simple short oblique parietal tooth, or ridge, with the outer end nearer the pillar. Greater diameter of the shell, 13.5 to 15 mm.; minor diameter, 11 to 13.5 mm.; altitude, 5.5 to 7 mm. in different specimens.

White Oaks, New Mexico, at an altitude of 7,500 feet, Ashmun. Type, No. 107611, U.S.N.M. The aperture of this form is quite peculiar.

With these shells were the following species, all said to be from New Mexico, but of which the exact locality was not stated: *Conulus fulvus*, *Vitrea arborea*, *V. indentata*, *Vallonia cyclophorella*, *Vitrina limpida*, Gould, *Helicodiscus lineatus*, *Pupa armifera*, and *Cionella lubrica*.

POLYGYRA MEARNSII, Dall.

(Plate XXXII, figs. 7, 8, 11.)

Polygyra mearnsii, DALL, Proc. U. S. Nat. Mus., XVIII, p. 2, 1895.

Shell depressed, 5-whorled, of a pinkish-brown color, sculptured only with moderately conspicuous incremental lines; spire much depressed, but not quite flat, a nuclear whorl and a half smooth, the rest striated more or less distinctly; in perfectly fresh specimens the surface is probably polished; suture very distinct; periphery rounded, but nearer the upper surface of the whorl; base rounded, but having a compressed appearance; umbilicus deep and narrow, except that a small portion of the half whorl preceding the last whorl is visible; termination of the last whorl slightly descending above and, below the periphery, strongly constricted behind the reflected lip of a very oblique aperture; peristome somewhat flexuous, reflected, united over the body by a distinct callus; body with two converging lamellæ, not united at the inner ends into a ∧, the basal lamella stouter and its outer extreme bent

toward the umbilicus; basal part of the peristome with two distinct, clear-cut lamellæ transverse to the lip; outer lip broader than the rest, receding, with a similar lamella set on somewhat obliquely and more deeply within the aperture. Height of shell 5.5, maximum diameter 13, minimum diameter 11 mm.

Huachuca Mountains, Arizona, and Hachita Grande Mountain, Grant County, New Mexico, Dr. Mearns, at an altitude of 8,000 to 9,400 feet. No. 130012, U.S.N.M.

No living specimens were collected, but the number of dead ones indicates that the species is not uncommon where found. This species is instantly distinguishable from any of the other species of *Polygyra* which possess a Λ-shaped parietal lamella by the presence of three distinct, well-defined teeth on the outer lip. All the other forms have two, or two with an obscure undeveloped flattening in addition. These teeth closely resemble those of *Polygyra levettei*, and if that species had two parietal lamellæ and was more depressed, it would differ from *P. mearnsii* chiefly by its greater size and number of whorls. *P. mearnsii* therefore forms a connecting link between those forms which have been called *Dædalocheila* and *Triodopsis*.

Family PUPIDÆ.

Genus HOLOSPIRA, Martens.

This genus was separated from *Cylindrella* by Albers[1] under the name of *Acera*, which had already been used in zoology and for which Von Martens in his new edition of Albers's work[2] substituted *Holospira* and named *H. pilocerei*, Pfeiffer, as the type. The following is a free translation of the diagnosis of Albers:

"Shell with an umbilical chink, turreted or spindle-shaped, with a conical not truncate apex; 11 to 14 whorls of which the last is little or not at all protracted; base carinate; columella plicate; aperture quadrangular; peristome free, expanded."

Holostoma pilocerei appears to be a rare shell; at least I have not been able to examine a specimen, though many so named, but which proved different, have come under inspection. The figures of this species are somewhat discrepant as already noted by Crosse and Fischer,[3] and may represent more than one species, since the internal structure was not examined by Pfeiffer and the external characters, beside being somewhat variable, are very similar in the different species. However, three of the original Pfeifferian specimens were examined by Strebel and Pfeffer[4] who describe the internal characters. It has a plait on the pillar and, near the end of the penultimate whorl, three other

[1] Heliceen, p. 209, 1850.

[2] Page 39, 1860.

[3] Moll. Terr. et Fluviat. de Mexique, I, p. 330.

[4] Beitr. zur Kennt. der Fauna Mex., p. 82, 1880.

lamellæ, one basal, one parietal, and one on the outer wall of the whorl less strongly developed. An examination of the anatomy by the authors cited shows that the group is related more closely to the *Pupidæ* than to *Cylindrella* with which it was originally associated. The first information as to the internal characters of *Holospira* was given by Bland,[1] who pointed out that *H. goldfussii*, Menke, beside the ridge visible in the upper part of the throat of the aperture, possesses in the penultimate whorl four lamellæ; one very prominent descending from the roof of the whorl for half a gyration; a less prominent one arising from the floor of the whorl opposite the first; a third, more feeble, projecting inwardly from the outer wall, and a fourth revolving on the pillar, but obsolete on the axis above the penultimate whorl. These lamellæ are figured by Strebel and Pfeffer.[2] The axis in *Holospira* is tubular and under magnification is seen to be vertically streaked with opaque white and translucent markings. In the more slender species like *H. goniostoma*, Pfeiffer, the tube is quite slender; in those which have a shell more stout and clublike, e. g., *H. elizabethæ*, Pilsbry, the axis is wide and spindle-shaped, but in all the base of the adult shell has the axis closed and the umbilicus represented by an impervious chink.

The angulation of the terminal part of the last whorl varies in the different species, some of which have a keel above and others show one below, the aperture may be subcircular, subtriangular or subquadrate, and may or may not be provided with a columellar or parietal ridge running inward and usually not very prominent. From this ridge the internal lamellæ are entirely distinct.

An examination of the internal characters shows that the group is naturally divided into sections which may possess any or none of the lamellæ referred to, and that these characters appear to be constant and invariable within the species. By sacrificing the integrity even of single specimens, when the collection contained but one of a species, I have been able to determine the characters of a large number of forms. I find the following to be destitute of any armature upon the pillar and of any internal lamellæ, and therefore to be referable to the subgenus *Metastoma*, Strebel and Pfeffer, of which *H. roemeri*, Pfeiffer, is the type: *H. roemeri*, Pfeiffer, *H. pasonis*, Dall, *H. coahuilensis*, W. G. Binney, *H. tenuisculpta*, Stearns, *H. pfeifferi*, Menke, and *H. remondi*, Gabb, the first-mentioned species having the tubular axis exceptionally large. To these I am now able to add two new species *H. crossei*, Dall, and *H. pilsbryi*, Dall, which last has existed in our collection for a long time under the erroneous name of *H. tryoni*, Pfeiffer. The latter species has been examined by Strebel and Pfeffer and is shown by them from authentic specimens to have entirely different internal characters. They have proposed for it the sectional name of *Bostrichocentrum*, characterized by having a spiral ridge around the axis extending from

[1] Ann. Lyc. Nat. Hist., N. Y., VIII, p. 160, 1865.
[2] Plate XIV, fig. 17B.

the last whorl upward throughout the spire, but no other lamellæ internally. Their specimens agree with Pfeiffer's types now in the Dohrn collection.

It is obvious from the preceding observations that some shells which are distinctly separated by their internal features show very similar external characters, and I may add that the examination of large numbers of specimens of several species indicates that the internal characters are persistent and invariable within the species. I propose to use these characters for arranging the genus *Holospira* into subordinate groups as follows:

Genus HOLOSPIRA, Von Martens.

Type.—*H. pilocerei*, Pfeiffer.

Subgenus HOLOSPIRA, s. s.

Axis large, with a ridge or plait developed in the penultimate whorl, and with parietal, basal, and peripheral lamellæ projecting into the lumen of the whorl.

Type.—*H. pilocerei*, Pfeiffer.

This includes *H. goldfussii*, Menke, sp., and *H. goniostoma*, Pfeiffer.

Section BOSTRICHOCENTRUM, Strebel and Pfeffer, 1880.

Axis moderate, with a continuous plait on it extending from the last whorl nearly to the apex.

Type.—*H. tryoni*, Pfeiffer.

H. veracruziana, Dall, belongs in this section.

Section HAPLOSTEMMA, Dall.

Haplostemma, DALL, Nautilus, IX, p. 50, Sept., 1895; Proc. U. S. Nat. Mus., XVIII, p. 2, 1895.

Axis moderate, with a short, stout, axial lamella extending about half a gyration in the penultimate whorl, but elsewhere simple and smooth.

Type.—*H. mearnsii*, Dall.

Section EUDISTEMMA, Dall.

Eudistemma, DALL, Nautilus, IX, p. 50, Sept., 1895; Proc. U. S. Nat. Mus., XVIII, p. 3, 1895.

Penultimate whorl with a short axial and a parietal lamella only, the axis moderately large.

Type.—*H. arizonensis*, Stearns.

Section DISTOMOSPIRA, Dall.

Distomospira, DALL, Nautilus, IX, p. 50; Proc. U. S. Nat. Mus., XVIII, p. 3, 1895.

Penultimate whorl with a short strong axial and a basal lamella only; axis smooth, moderately large.

Type.—*H. bilamellata*, Dall.

Subgenus METASTOMA, Strebel and Pfeffer.

Axis smooth, without plaits or sinuosity; penultimate whorl without internal laminæ.

Type.—H. roemeri, Pfeiffer.

This comprises most of the species included hitherto under the name of *Holospira*.

Subgenus COELOSTEMMA, Dall.

Coelostemma, DALL. Nautilus, IX, p. 50; Proc. U. S. Nat. Mus., XVIII, p. 3, 1895.

Axis vertically ribbed as in *Coelocentrum*, capacious, shell otherwise as in *Metastoma*.

Type.—H. elizabethæ, Pilsbry.

The Holospiras are included in a subfamily Eucalodiinæ of the Pupidæ, by Crosse and Fischer, though formerly referred to the Cylindrellidæ. It might, perhaps, be premature to attempt to separate this group as a family from the Pupidæ. There are, however, some interesting parallels in the groups included under the names of *Cerion*, *Holospira*, *Coelocentrum*, and *Eucalodium*. These groups seem to vary in somewhat similar directions as regards internal characters. Thus *Coelocentrum* is characterized by curious vertical ribs on the axial wall, such as exist in *Holospira* (*Coelostemma*) *elizabethæ*, Pilsbry; the shell is habitually decollate, with a pervious axis, and externally flexuously ribbed with transverse riblets. A few species have also spiral striation. To this group Crosse and Fischer referred the *Cylindrella irregularis* of Gabb from Lower California, which by its general character is doubtless most nearly related to *Coelocentrum*, but differs by wanting the most remarkable of the generic characters assigned to that genus. Instead of having the axial wall vertically ribbed as in *Coelostemma*, it has a revolving inflation extending the whole length of the axis as in *Bostrichocentrum*, and should therefore be separated as a subgenus for which I have proposed the name *Spartocentrum*.[1] In this conclusion Mr. Pilsbry agrees, and I take this opportunity of expressing my serious obligations to that gentleman for valuable advice and suggestions afforded during the course of a free correspondence relating to the subject-matter of the present report.

In the genus *Eucalodium*, Crosse and Fischer, we have an allied group habitually decollate like *Coelocentrum*, but having a solid axis. They are large shells living on the surface of the ground in moist places, under dead leaves and similar accumulations. Here also we find two groups indicated by the internal characters of the axis. The typical species, *E. giesbrechtii*, Pfeiffer, has the axis sinuous and provided with a plait extending its whole length, except in the immediate vicinity of the aperture. The radula is wide with a formula of 65:1:65 for the transverse row. The other group has a straight, smooth axis and a narrow

[1] Nautilus, IX, p. 51, Sept., 1895; Proc. U. S. Nat. Mus., XVIII, p. 3, 1895.

radula, the latter with a transverse series of 36:1:36. For this division of the genus Mr. Pilsbry proposed the sectional name *Oligostylus*, of which *Eucalodium blandianum*, Crosse and Fischer, serves as the type. The relation of these two groups to each other recalls that of *Bostrichocentrum* to *Metastoma* among the Holospiras. In the genus *Cerion* I have already divided the group into sections characterized by the internal laminæ, which appear to afford good characters and recall to some extent the features exhibited internally in *Holospira*. There is a curious similarity in general form and top-heaviness between many of the species of *Cerion* and *Holospira*.

In this connection I have added the descriptions of four Mexican species belonging to *Coelocentrum*, *Anisospira* and *Streptostyla*, which were obtained by Mr. E. W. Nelson while exploring for the United States Department of Agriculture in this region, as it seemed desirable to concentrate the published data on this fauna and would add to the interest of this report.

HOLOSPIRA (METASTOMA) CROSSEI, Dall.

(Plate XXXI, fig. 2.)

Holospira (Metastoma) crossei, DALL, Proc. U. S. Nat. Mus., XVIII, p. 3, 1895.

Shell small, compact, 12-whorled, of a brownish gray color; nuclear whorls 2, smooth, polished, apically blunt, succeeding 4 gradually and evenly increasing, after which the shell is cylindrical; sculpture of pretty even, slightly oblique, rounded riblets, extending from suture to suture and separated by interspaces twice as wide as the ribs; suture distinct; base rounded, with a shallow umbilical chink; aperture simple, slightly oblique, not projecting beyond the periphery of the preceding whorl, the lip slightly expanded in front of a faint constriction, the opening subcircular without internal ridges, the outer anterior part obtusely angular; axis small, regularly increasing to the last whorl, not inflated. Length of shell 11, maximum diameter 4 mm.

Top of Hachita Grande Mountain, Grant County, New Mexico, Dr. Mearns. No. 129989, U.S.N.M.

This species resembles *H. goldfussii*, Menke, but is slightly smaller, with a shorter neck to the aperture and a less reflected and triangular peristome. It is entirely destitute of the remarkable internal lamellæ which characterize *H. goldfussii*. It is named in honor of M. H. Crosse, who has monographed the genus.

HOLOSPIRA (METASTOMA) PASONIS, Dall.

(Plate XXXI, figs. 4, 5.)

Holospira pasonis, DALL, The Nautilus, VIII, p. 112, Feb., 1895.

This fine species was obtained by Mr. Singley from a collection made at Mule Canyon, El Paso County, Texas, at an elevation of 4,000 feet. As it belongs to the same general region and may be advantageously

compared with the following species, I have included this reference and figure here. It belongs to the typical section of the genus without internal lamellæ, and has a length of 22.5 and a maximum diameter of 6.5 mm.

HOLOSPIRA (METASTOMA) PILSBRYI, Dall.

Holospira (Metastoma) pilsbryi, DALL, Proc. U. S. Nat. Mus., XVIII, p. 4, 1895.

Shell small, bluish or pinkish white; the nucleus darker, 2-whorled, smooth, not much projected, followed by 6 obliquely striate, gradually increasing whorls which form a beehive-shaped dome to the spire, after which follow 6 nearly equal, almost smooth whorls, forming a nearly cylindrical spire; the last whorl slightly smaller, the base and neck near the aperture somewhat irregularly transversely wrinkled; suture distinct, here and there edged by wrinkles transverse to the whorl, but more or less obsolete, except near the suture; umbilical chink shallow; aperture a little oblique, subcircular, with a faint angulation near the upper outer corner; lip expanded, but hardly reflected; the peristome, viewed in its own plane, does not project beyond the lines representing the sides of the cylindrical part of the spire, but as the last whorl is smaller than those preceding it, the peristome projects slightly from it; throat of the aperture whitish, without ridges; axis straight, slender, axial wall smooth. Length of large specimen 13, diameter 4 mm., with 14 whorls; length of short specimen 10.25, diameter 3.75 mm., with 12 whorls.

Arizona or New Mexico, Dr. E. Palmer, U.S.N.M.; also abundant around sulphur springs near the city of Puebla, State of Puebla, Mexico, from the Mexican Geographical Commission. No. 56932, U.S.N.M.

A single specimen was found among loose shells brought home by Dr. Palmer after a trip through Arizona and New Mexico, but no particular locality could be assigned to it. Another from an unknown collector appears in the national collection marked simply "Mexico," but a fine series from the city of Puebla was presented by the Mexican Geographical Commission, and about the locality of these there is no doubt whatever. The Academy of Natural Sciences, Philadelphia, has the species from the same locality. It was long marked *H. pilocerei* in the collection, but belongs to a different section of the genus. Externally it can hardly be distinguished from *H. tryoni* as figured by Crosse and Fischer.

HOLOSPIRA (DISTOMOSPIRA) BILAMELLATA, Dall.

(Plate XXXI, fig. 3.)

Holospira (Distomospira) bilamellata, DALL, Proc. U. S. Nat. Mus., XVIII, p. 4, 1895.

Shell elongate, slender, blunt-tipped, with two smooth nuclear and 15 subsequent whorls; the spire increases evenly to the eighth whorl and then very slowly attenuates; sculpture of slightly oblique little

raised, nearly straight riblets with doubly wide interspaces marked by somewhat irregular lines of growth; the sculpture between the ninth and the last whorl is more or less obsolete, but on the last whorl is strong, crowded, and a little irregular; suture distinct; base a little appressed; umbilical chink small; aperture as in *H. crossei*, but projecting beyond the periphery of the last whorl. Length of shell 20.5, maximum diameter 5 mm. With *H. crossei*, not uncommon. No. 129990, U.S.N.M.

This species in form recalls *H. semisculpta*, Stearns, but is smaller, without the polished surface of the latter and of a ferruginous white instead of the bluish color of *H. semisculpta*. The aperture in some specimens projected more than in others which seemed fully adult. The internal armature consists of a short very wide flange near the base on the pillar and a low but strong basal ridge extending about one-third of a gyration slightly nearer the inner than the outer wall of the whorl.

HOLOSPIRA (HAPLOSTEMMA) MEARNSII, Dall.

(Plate XXXI, fig. 1.)

Holospira (*Haplostemma*) *mearnsii*, DALL, Proc. U. S. Nat. Mus., XVIII, p. 4, 1895.

Shell small, compact, with 14 whorls, of which 2 are nuclear, polished, and smooth; blunt above, gradually increasing to the ninth whorl and subsequently slightly attenuated; sculpture and aperture much as in *H. crossei*, the base slightly appressed and the ribs closer and more prominent than on the previous whorls; umbilicus not conspicuous; aperture projecting somewhat beyond the preceding whorl, the peristome hardly reflected, subtriangular, little thickened, without folds; axis small, subcylindric, with a strong, short lamella near the base in the penultimate whorl. Length of shell 14.5, maximum diameter 4.5 mm. Found with *H. crossei*, but less common. No. 129991, U.S.N.M.

This species resembles *H. crossei* in general appearance, but is larger, with more projecting aperture, and frequently has an intercalary raised line dividing the interspaces of the ribs axially. The specimens are of a whitish color.

The following species contained in the National Museum was named *H. tryoni*, Pfeiffer, on an old label, but on comparison with the literature proved to be quite distinct from that species, which is asserted by Crosse and Fischer to be quite destitute of internal armature.

HOLOSPIRA (BOSTRICHOCENTRUM) VERACRUZIANA, Dall.

Holospira (*Bostrichocentrum*) *veracruziana*, DALL, Proc. U. S. Nat. Mus., XVIII, p. 4, 1895.

Shell closely resembling the enlarged figure of *H. microstoma*, Pfeiffer,[1] but with a shorter apical cone and larger aperture. According

[1] Crosse and Fischer, Miss. Sci. au Mexique, Moll., p. 337, pl. XVII, figs. 9, 9a.

to the descriptions of *H. microstoma*, the present species differs by having 17 whorls in a total length of 17.5 mm. against 18 whorls in a length of 15.5 mm. for *H. microstoma*, both having a maximum diameter of 5 mm. The last whorl in the present species is rounded below, that of *H. microstoma* angulated; in *H. veracruziana* the aperture is expanded, with the outer posterior part hardly angular where the outer lip meets the parietal portion; the diameter of the aperture is 3.5 mm. (against 2.6 in *H. microstoma*), and the parietal portion is very little extended beyond the periphery of the preceding whorl; the whorls of the nucleus (1½) are smooth and polished, those of the apical cone finely ribbed, those of the rest of the spire striate, with a few coarse riblets just behind the peristome.

Three specimens from Mizantla, province of Vera Cruz, were presented to the National Museum by the Mexican Geographical Commission.

This species has a strong, short fold at the base of the axis in the penultimate whorl, but no traces of any other laminæ. It is possible that the type of *H. microstoma* of Pfeiffer may have the aperture abnormal and be identical with this species, but, in the uncertainty, I have preferred to name the latter.

The following list comprises all the known species of *Holospira* to date:

Holospira goniostoma, Pfeiffer. Southwestern Mexico.
Holospira pilocrei, Pfeiffer. State of Puebla, Mexico.
Holospira goldfussi, Menke. Southwestern Texas, west of Colorado River.
H. (*Bostrichocentrum*) ***tryoni***, Pfeiffer. State of Puebla, Mexico.
H. (*Bostrichocentrum*) ***veracruziana***, Dall. Vera Cruz, Mexico.
H. (*Haplostemma*) ***mearnsii***, Dall. New Mexico.
H. (*Eudistemma*) ***arizonensis***, Stearns. Arizona.
H. (*Distomospira*) ***bilamellata***, Dall. New Mexico.
Metastoma roemeri, Pfeiffer. Texas, west of the Colorado River.
Metastoma pasonis, Dall. El Paso County, Texas.
Metastoma coahuilensis, W. G. Binney. Coahuila, Mexico.
Metastoma semisculpta, Stearns. Chihuahua, Mexico.
Metastoma pfeifferi, Menke. Sonora, Mexico.
Metastoma rémondii, Gabb. Sonora, Mexico.
Metastoma crossei, Dall. New Mexico.
Metastoma pilsbryi, Dall. Puebla, State of Puebla, Mexico.
M. (*Cœlostemma*) ***elizabethæ***, Pilsbry. State of Guerrero, Mexico.

The interior of the following species is unknown:

Holospira gealei, H. Adams. Puebla, Mexico.
Holospira imbricata, Martens. Mexico.
Holospira cretacea, Pfeiffer. Mexico.
Holospira microstoma, Pfeiffer. Mexico.
Holospira teres, Menke. Puebla, Mexico.

Total, 22 species.

The geographical distribution of the group is as follows: In the southern extreme of Mexico, Puebla affords 5, Vera Cruz 1, Guerrero 1, and other localities probably in this region 4, in all 11 South Mexican

species. In northern Mexico, Sonora offers 2, Chihuahua 1, and Coahuila 1, making 4 for this area; while on the United States side of the boundary, Texas west of the Colorado River affords 3, New Mexico 3, and Arizona 1 species or 7 in all, of which 3 described in this paper are due to the collections made on the Boundary Commission by Dr. Mearns. A large number of species probably remain to be made known.

Genus COELOCENTRUM, Crosse and Fischer.

COELOCENTRUM NELSONI, new species.

(Plate XXXIII, figs. 5, 6.)

Shell, large, strong, decollate, retaining 9 whorls subcylindric, attenuated more rapidly at the upper 2 or 3 whorls, periphery flattish, suture distinct, strong, not deep; transverse sculpture of numerous rather asperate concavely arched little raised ridges stronger near the sutures and usually with wider interspaces; spiral sculpture of somewhat vermicular obscure character like the markings left by a "sand-blast," but occasionally developing sparse distant fine spiral riblets, and stronger on the later whorls; base rounded except for the obscure peripheral line, the umbilicus almost closed; aperture rounded below, slightly angular, oblique, free from the body whorl, with the margin continuous and reflected but narrow; axis normal, nearly closed at the decollation where it is small but large in the later whorls; color pale straw. Length 53, maximum diameter 18, diameter at decollation 8 mm.

Type from Tuxtla, Mexico; collected by E. W. Nelson, of the United States Agricultural Department. No. 107368, U.S.N.M.

This shell recalls *Eucalodium compactum*, Pilsbry, but is more cylindrical and stouter, besides having a totally different axis. It is the largest known species of the genus, and is dedicated to the indefatigable naturalist, E. W. Nelson, who has added so largely to our knowledge of the American fauna from Alaska to Guatemala.

COELOCENTRUM PFEFFERI, new species.

(Plate XXXIII, figs. 1, 2.)

Shell subcylindric, with 8½ whorls, attenuated above, rounded below, solid, decollate, the whorls gently rounded with a distinct suture, without spiral sculpture, transverse sculpture of delicate, hardly arched, little raised, crowded lines, subequal over the whole surface; base rounded, the basal area bounded by an obscure line, umbilicus reduced to a minute perforation, aperture rounded below, slightly angular above, usually free but occasional adnate to the body whorl; axis normal, small at the decollation; color pale livid pink, whitish near the aperture. Length 43, maximum diameter 15, diameter at the decollation 7 mm. No. 107367, U.S.N.M.

Types from Ocozucuantla, Mexico; collected by E. W. Nelson.

This species is shorter, stouter, and less cylindrical than *C. turris*, Pfeiffer, which has proportionally more numerous whorls and is smaller and more fusiform than *C. nelsoni*. It is respectfully dedicated to the distinguished naturalist of Hamburg, Dr. G. Pfeffer, well known for his work on Mexican land shells in conjunction with H. Strebel.

Genus ANISOSPIRA, Strebel and Pfeffer.

ANISOSPIRA STREBELI, new species.

(Plate XXXIII, figs. 7, 8.)

Shell thin, white, solid, opaque, decollated, the rejected spire having 1¼ whorls and the remainder of the shell from 7¼ to 9 whorls; apex of the young shell blunt, slightly dome-shaped, the nepionic shell smooth or faintly transversely striated, subsequent whorls to the fifth subcylindric, the fifth slightly constricted, the spire very slowly increases in diameter until the decollation is reached; the first four whorls after the nucleus are conspicuously, elegantly, transversely ribbed, the riblets nearly straight, with subequal interspaces. Beyond the constriction the riblets are less conspicuous and more crowded and more oblique, and so continue evenly over the adult shell where the suture is distinct but not deep, the form somewhat fusoid, the basal whorl slightly contracted and subangulate at the periphery, the umbilicus closed and the aperture suborbicular and lightly reflected. The axis is moderately stout and twisted, with a single plait on the pillar, anteriorly, in the last and penultimate whorls, not however visible from the aperture, much as in *A. liebmanni*, Pfeiffer. Length of decollate spire, 21 mm.; of decollated shell, 29 mm.; maximum diameter of shell, 10 mm.; of decollation, 6 mm.

Types from Huilotepec, Oaxaca, Mexico; collected by E. W. Nelson. No. 107366, U.S.N.M.

This species is shorter and more slender than *A. hyalina*, Pfeiffer, which has always 1 and sometimes 2 more whorls. It is of a whitish, not a pinkish tint, and the decollated portion of the spire is more cylindrical than in *A. hyalina*, which has a proportionally larger and more trumpet-like mouth. *A. liebmanni* is larger, stouter, of a brownish yellow color, and has a whorl less than the present species, which is respectfully dedicated to Herr H. Strebel, joint author of the work on Mexican land shells already alluded to.

Genus CIONELLA, Jeffreys.

CIONELLA LUBRICA, Müller.

A single specimen was obtained at an altitude of about 9,400 feet on the summit of the Huachuca range, Cochise County, Arizona, by Dr. Mearns. This is the most southern locality definitely known in the United States for this species. It has been obtained by Hemphill in the Weber Canyon, Utah, and at White Earth, Colorado, by Ingersoll,

but these localities are several hundred miles to the northward of Dr. Mearns' station. There would seem to be no reason why the species may not extend still farther south in suitable localities among the mountains of Mexico. The species is reported from near Caracas, Venezuela, by Jousseaume. The Arizona specimen, like other southern individuals, is somewhat smaller than the best developed northern form, and might be referred to the variety *lubricoides*, Ferussac, if worth naming.

Genus BULIMULUS, Leach.

The Bulimuli considered in this paper belong to the subgenus *Orthotomium*, Crosse and Fischer, as restricted by Pilsbry. If we follow the obnoxious practice of rejecting names which have been used in another gender with a different spelling, as synonyms, we must replace the section *Leptobyrsus*, Crosse and Fischer, by *Sonorina*, Pilsbry, for species of the *spirifer* type. *Orthotomium*, s. s., practically covers the rest, except a few aberrant elongated pupiform species for which Cooper's name, *Plicolumna*, may be used.

The Bulimuli of northern Mexico are intimately related to those of the southwestern United States and of the peninsula of Lower California. The fauna of the last mentioned region has something of an insular character, having been in comparatively recent geological time isolated from the continent by an arm of the sea extending in the vicinity of the international boundary line from the Pacific to the Colorado Basin and the head of the Gulf of California.

Owing to the intercourse between the opposite coasts of the Gulf of California it has happened that species have been submitted to naturalists as coming from the peninsula which really belong to the mainland, but it is by no means certain that there are not a number of common species. I received from Dr. J. G. Cooper, in the same parcel with well-known peninsular species and without any distinctive label, a number of specimens of *Bulimulus baileyi*, which is also represented in the National Museum collection by specimens collected on the peninsula by W. J. Fisher. Dr. Cooper now thinks that his specimens of *B. baileyi* were collected at Hermosillo, Mexico, and we have specimens from northern Mexico, collected by Bailey. So it seems that a doubt is thrown on the peninsular habitat of *B. baileyi* which it will require further researches to dispel. It must be remembered, however, that *B. pallidior* is represented by a very slightly modified variety on the mainland as far south as Costa Rica, notwithstanding the fact that its center of distribution is certainly the mountains[1] of the peninsula.

Epiphragmophora hachitana was collected by Merrill a little to the south of San Quentin, Lower California (lat. 30° N.), although it seems

[1] It is hardly necessary to insist on the errors of habitat which assigned this species to Peru and the South Sea Islands, from which no specimens are known.

to be a characteristic species of the mountain peaks of northern Mexico. It is evident, therefore, that it will not do to be dogmatic about doubtful localities connecting the mainland and peninsular faunas. The isolation of each by desert tracts of lowland is almost as complete as if it were by water, but a thorough search will probably reveal a number of species common to both regions.

Although the Boundary Commission at the northern border of Lower California did not reach the mountains where the peninsular fauna flourishes, it seems permissible here to discuss some species of the latter which are genetically connected with others touched on in this report and belong to the same faunal region in its broader sense.

Since this paper was originally written (January, 1895) Mr. Pilsbry has proposed a revision of the American Bulimuli, based on the typical species of each group and especially the characters of the nepionic shell. This revision[1] has been utilized and the names adopted in it have been used here in place of those previously current.

In discussing the land shells of Lower California, Dr. J. G. Cooper has expressed certain opinions to which it seems necessary to refer, as otherwise some misconceptions might be perpetuated in spite of Mr. Pilsbry's revision. The subgenus *Rhodea* was created by the brothers Adams in 1858 for the *Achatina californica* of Pfeiffer. The type is now known to inhabit the mountains of New Grenada and the adjacent region and to have no relation to the African genus *Columna*, Perry, to which it was referred by Adams as a subgenus. An excellent review of the group (raised to generic rank) containing good figures of the species was published by H. Crosse,[2] and it is also treated of in the great work on the Mexican land shell fauna by Crosse and Fischer. For historic details the reader is referred to these monographs.

The principal characters of *Rhodea* consist in its elongated parallel-sided form, smooth, dome-shaped, *Stenogyra*-like nucleus, the distinct sutural keel more emphasized in the later whorls; the constriction of the last whorl, medially; the gyrate columella in the last whorl or two, making a pervious axis; the channel behind the columella which forms a rounded prominent fasciole encircling the axis, and in the adult terminates in an angular sinus in the otherwise continuous peristome. The anatomy is helicoid, the jaw is furnished with a few strong, distant vertical ribs, and the animal is ovoviviparous, like *Stenogyra*. One of the species is sinistral, the others dextral, but all are very much alike and sculptured only with transverse striations.

The California Academy of Sciences has sent several expeditions into the adjacent parts of Mexico and the peninsula of Lower California, during which interesting land shells were collected by Dr. G. Eisen and other members of the party. These have been described in the publications of the academy by Dr. J. G. Cooper. Among them were some

[1] The Nautilus, IX, No. 10, pp. 112–115, Feb., 1895.

[2] Journ. de Conchyl., XXIV, p. 5, 1876.

elongated forms strongly resembling the original *Rhodea californica* and others of *Stenogyra*-like aspect which, in default of anatomical details, were provisionally referred to *Melaniella*. Later explorations resulted in obtaining from the Sierra San Lazaro, about 25 miles north of Cape St. Lucas, living specimens of *Bulimulus artemesia*, W. G. Binney, *Columna ramentosa*, Cooper, *Melaniella eiseniana*, Cooper, and *Vitrea indentata*, Say, examples of which were sent to me by Dr. Cooper in order that their true relations might be determined by an examination of the anatomy.

Recent researches on the anatomy of the Helicidæ by Ihering, Pilsbry, Hedley, and others have shown conclusively that the external modifications of the shell alone are not a sufficient guide to the genetic relations of the animals concerned, and that under similar environmental influences the Helicidæ, taken in a broad sense, of different countries and different genetic history, produce strikingly similar modifications of their shelly envelopes. These have hitherto naturally been assumed to indicate a relationship which we now know does not exist. Further, it appears that a more minute scrutiny of the shells referred to does in many cases reveal characters in them which, in the light of our new information, point to their real affinities, but which have hitherto been overlooked or regarded as of too little importance to be worth dwelling upon.

An examination of Dr. Cooper's shells affords striking confirmation of the new views above referred to and shows that notwithstanding superficial similarities the Californian and South American forms can not be associated in the same minor group and genetically are of different origin. I should state here that I considered in a recent paper on the Bulimuli of Lower California[1] a number of the species collected by the expeditions of the California Academy and forwarded to the National Museum by Dr. Cooper in connection with a large series, including most of the original types or author's specimens of species of this group hitherto described from this region by Gould, Gabb, W. G. Binney,[2] and others. In his paper on "Land and fresh-water mollusks of Lower California, No. 4," Dr. Cooper, who had not had access to a series named by me or to the original types above mentioned, ventured on some criticisms of my work. These criticisms are almost wholly based on misidentifications of species or misconception of facts, and, in general, are vitiated by these errors. I will mention only one instance, as I have no desire to enter into controversy and prefer to allow the specimens, properly identified in the Museum series, to speak for themselves. Dr. Cooper is under the impression that *Bulimulus pallidior* exists as a South American species, and that Binney and Bland have described the dentition of Peruvian specimens. Now, these authors specifically state that their specimen was from Lower California, and it has long been

[1] Proc. U. S. Nat. Mus., XVI, pp. 639–647, 1893.

[2] Proc. Cal. Acad. Sci., 2 ser., IV, pp. 130–143, 1894.

known that the reference of *B. pallidior* to South America was merely an error of habitat; that the species is only known from Lower California and Costa Rica. Hence there is no need of considering any (hypothetical) Peruvian species, as in the case of *B. proteus* where two very similar shells of different habitats had been confounded. Gould's type of *B. vegetus*, now in the National Museum, establishes its absolute identity with *B. pallidior*. Since Dr. Cooper's paper was printed it has been possible for me to examine a series of the species named by him from the collections made by the Academy expeditions to Lower California, which he kindly forwarded at my request.

Subgenus ORTHOTOMIUM, Pilsbry.

Orthotomium, PILSBRY, Nautilus, IX, No. 10, p. 114, Feb., 1896.
>*Orthotomium*, CROSSE and FISCHER, Moll. Mexique, 1875.
>*Leptobyrsus*, CROSSE and FISCHER, op. cit., 1875.
>*Globulinus*, CROSSE and FISCHER, op. cit., 1875.

The type of *Orthotomium* is *Bulimulus sufflatus*, and the group as a whole comprises the sections *Orthotomium*, s. s.; *Leptobyrsus*, Crosse and Fischer, (type *B. spirifer*, Gabb) or *Sonorina*, Pilsbry; and *Plicolumna*, Cooper (+ *Pseudorhodea*, Dall), of which the type is *B. ramentosus*, Cooper.

Section SONORINA, Pilsbry.

BULIMULUS (ORTHOTOMIUM) BELDINGI, Cooper.

Bulimulus inscendens beldingi, COOPER, Proc. Cal. Acad. Sci., III, p. 209, 1892; p. 340, pl. XIII, fig. 5; IV, p. 137, 1894.
Bulimulus (Leptobyrsus) inscendens, BINNEY, var. *beldingi*, DALL, Proc. U. S. Nat. Mus., XVI, p. 643, 1893.

Mountains of Lower California, Eisen and others.

I noted my suspicion in 1893 that this form is specifically distinct from *B. inscendens*, and, after examining Dr. Cooper's series, I am confirmed in this opinion. I do not find on careful scrutiny the intermediate stages which would connect the two species, and I now separate them definitively. To the typical form, as originally described by Cooper, I add two varieties, named and characterized in the above-mentioned paper as var. *alta* and var. *monticola*.

The jaw of *B. beldingi* is essentially like that of *B. artemesia*, but heavier, with the plications carried to the dorsal edge. The teeth differ only in being more numerous. The animal is dark, slaty-black above and pale below, with the edge of the foot marginated by a row of granulations.

BULIMULUS (ALTERNATUS var.?) NIGROMONTANUS, Dall.

Shell short, wide, white, with 5 whorls, rather rudely striated in harmony with the lines of growth; nuclear whorls 2, neatly, evenly sculptured with fine, usually wavy, minute ribs, the summit with a small central

funicular dimple; whorls moderately rounded, the last much the largest, the spire obtusely conical; base full and rounded, with a rather large, deep, and subcylindrical umbilicus; outer lip sharp, hardly reflected; pillar lip reflected rather widely near the body around (not over) the umbilicus; body with a thin wash of callus, the outer lip strongly incurved at its junction, giving a somewhat tubular look to the suture; substance of the shell thin, without markings. Length 18, of the last whorl 13, maximum diameter 11 mm.

Summit of Black Mountain, Sonora, Mexico; Dr. Mearns. No. 129993, U.S.N.M.

The shells above described are not in the best condition, and I have some hesitation in describing them; but after an exhaustive comparison with the Bulimuli of the region and of Lower California I find none to which the present form can be confidently assigned. It recalls somewhat *B. xantusi*, Binney, and *B. baileyi*, Dall, but is smaller and more globose than either. In form some of the varieties of *B. alternatus*, Say, come nearest to it, but have a different surface and markings which are absent from the present form, and none of them has so deep and cylindrical an umbilicus. I have thought it best, therefore, to put it on record until the reception of more material shall enable a final decision to be made.

BULIMULUS (ORTHOTOMIUM) COOPERI, Dall.

Bulimulus pilula (CROSSE and FISCHER), COOPER, Proc. Cal. Acad. Sci., III, pp. 209, 340, pl. v, fig. 12, 1894.
Bulimulus cooperi, DALL, Proc. U. S. Nat. Mus., XVIII, p. 5, 1895.

The specimen figured as *pilula*, from San Jose del Cabo, by Dr. Cooper, is *B. pilula*, Crosse and Fischer, but not of Binney. The former, judging from their figure and from somewhat weathered specimens, has a peripheral band or bands, in which two darker bound a central paler zone; the surface has well-marked incremental lines, but no spiral striæ or granulations. It has been well figured by Crosse and Fischer and Cooper, though the latter does not show the bands, his specimens being bleached. There can be no doubt that this species is distinct from the original and only true *B. pilula*, and, since it does not seem to have been named, I have proposed for it the name of *Bulimulus cooperi*.

BULIMULUS (ORTHOTOMIUM) DECIPIENS, Cooper.

Bulimulus decipiens, COOPER, Proc. Cal. Acad. Sci., 2 ser., V, p. 164, June, 1895.

A third species was among these referred at first to *B. pilula*, with some doubt, by Dr. Cooper in the series submitted to me. Unfortunately, the specimens, though living when obtained, are not adult. They appear, however, to represent a very distinct species. The shell is of pale, livid, pinkish brown, with a peripheral, narrow, pale-yellow band. The largest specimen has a *Leptobyrsus* nucleus (not keeled) of

2 whorls, and about 2¼ rapidly enlarging later whorls. The suture is distinct, but not deep, the shell, when adult, is probably about the shape of *sufflatus*, but thinner; the umbilicus is deep, but very small, and almost hidden by the reflection of the pillar lip; the base is rounded; the surface marked by inconspicuous incremental lines and by spiral, microscopic but sharp, distant, slightly elevated lines, between which are still finer spiral striations. The general surface is not polished, even when perfectly fresh, but the wear on the fine elevated lines seems to polish them, so that under a strong triplet they shine against the duller background of the rest of the surface. This sculpture is very characteristic and quite unlike that of any other Lower Californian species. The shell above described measures 11.5 mm. high, of which the last whorl stands for 10 mm. and 9.5 mm. in diameter. It was collected by Eisen in the Sierra San Lazaro, near Cape St. Lucas, in September, 1894.

BULIMULUS (ORTHOTOMIUM) LEVIS, Dall.

Bulimulus xantusi var. *levis*, DALL, Proc. U. S. Nat. Mus., XVI, p. 641, 1893.—COOPER, Proc. Cal. Acad. Sci., 2 ser., IV, p. 139, pl. v, fig. 14, 1894.
Bulimulus levis, DALL, Proc. U. S. Nat. Mus., XVIII, p. 5, 1895.

Several fresh specimens obtained by Dr. Eisen on his last trip show that this species is covered with a smooth, polished, greenish-yellow epidermis, with vertical darker streaks instead of dark brown, as in *B. xantusi*, and it is absolutely without granulation. There is no doubt but that this is a distinct species, which can retain the varietal name in a specific sense. Decorticated specimens may have been distributed under the name of *xantusi* by collectors, but the original figured type of Mr. W. G. Binney must be taken as the standard for that species. With it the *B. gabbii* of Crosse and Fischer is identical, and must fall into synonymy.

BULIMULUS (ORTHOTOMIUM) PILULA, W. G. Binney.

This species does not appear among the shells forwarded for examination by Dr. Cooper. Of those sent under this name the majority were small or immature specimens of *B. sufflatus*, Gould, and its variety, *chinchensis*, Cooper.

Section PLICOLUMNA, Cooper.

Plicolumna, COOPER, Proc. Cal. Acad. Sci., 2 ser., V, p. 164, June, 1895.
Pseudorhodea, DALL,[1] Nautilus, IX, p. 51, Sept., 1895; Proc. U. S. Nat. Mus., XVIII, p. 5, 1895.

Shell resembling that of *Rhodea*, Adams, but without a keel on the upper side of the suture in the later whorls, without a channel behind

[1]The duplication of names is the result of my absence in Alaska at the time of the printing of both Dr. Cooper's paper and my own, which, as manuscript, was the earlier of the two.

the pillar and consequently without the resulting convex fasciole marginating the pervious axis; with a rounded and not excavated base; with a ribbed and funicular nepionic apical stage instead of a smooth and dome-like one, with a jaw differing as elsewhere described from the jaw of *Rhodea*, and probably by being oviparous.

The dentition of *Rhodea* has not been figured, so no comparisons can be made with it. *Plicolumna* is intimately related to the group of *Bulimulus*, including *Leptobyrsus* and such species as *B. artemesia*. It is probably the result of special factors of the environment acting on part of the same phylum. From them it differs by the persistence of a gyrate columella in the last 2 whorls and the resulting pervious axis, features which are absent from its nearest relative, *B. artemesia*. It is probable that the South American *Rhodea* is a similar modification of some local phylum, induced by analogous features in the environment.

BULIMULUS (ORTHOTOMIUM) ARTEMESIA, W. G. Binney.

(Plates XXXI, fig. 6; XXXII, fig. 6.)

Bulimulus (*Leptobyrsus*) *artemesia* (W. G. BINNEY), DALL, Proc. U. S. Nat. Mus., XVI, p. 642, pl. LXXII, fig. 5.

In my paper above refered to, this species was placed in a subdivision of the section *Leptobyrsus*, characterized by the absence of the concealed flange on the pillar which is so curious a feature of *B. bryanti*, *B. spirifer*, and *B. veseyianus*. Dr. Cooper supposing his *Columna ramentosa* to belong to *Rhodea*, and observing the indications of affinity between *B. artemesia* and his *Columna ramentosa*, criticises me for placing the former in the same group with the *Leptobyrsi* (=*Sonorina*, Pilsbry), and observes that it would better have been placed in *Peronæus* until it was certain that it does not belong with *Columna* (=*Rhodea*). Now *Peronæus* (*papiformis*) is a Chilian form, with the dome-shaped smooth nucleus of *Bostryx* belonging to that region, and, while the general outline is very like that of *B. artemesia*, the nuclear whorls are as far as possible removed from the ribbed funicular form which characterizes the species of Lower California. Consequently, though having but a single specimen of the shell, the type of *B. artemesia*; I did not hesitate to place it among the forms, which by propinquity, as well as nepionic characters, were distinctly pointed out as related to it. On the other hand, the shell has not a single one of the characters upon which the true *Rhodea* must rely for its validity. Yet Dr. Cooper, judging the true *Rhodea* by the shells, which at first under the name of *Columna* he wrongly referred to it, was not incorrect in supposing these to be related to *B. artemesia*. They are very closely related to it, and, without doubt, are derived from the same stock, and the similarity of *Columna* (Cooper) to *Rhodea*, Adams, is dynamic and superficial and not genetic, as I shall now proceed to show.

In nearly all the Lower Californian *Bulimuli*, from the great *B. montezuma* down to the small *artemesia*, the nepionic or nuclear whorls

present a special aspect rather unusual among species of this genus. The subspherical or bulb-like protoconch with which the shell begins, and which is formed within the egg, when the coiling of the whorls commences, is tipped over and obliquely infolded by the first gyration; a section shows more of the protoconch below than above the first sutural line. The coiling whorl is often strongly keeled on the shoulder, so that from the keel toward the suture is a straight downward slope, while the external surface from the keel toward the periphery is rounded. The circular sweep of the keeled first whorl thus forms an apical funicular depression where the point of the spire usually is. In those cases where the first whorl is not keeled it nevertheless shows a dimple or pit at the apex, though not so sharply emphasized. The first 1¼ or 2 whorls are regularly ribbed with small, distinct, even ribs and about equal interspaces, directed vertically or parallel with the axis. Beyond this point the ribs fade and are represented by oblique more or less flexuous elevated incremental lines, often granulated by the crossing of about equally strong spiral striæ with equal interspaces. This granulation is often inconstant; some of the species may show it well developed over the whole shell, or may be almost free from it, though there are some which are always smooth or even polished, and others which are not known without a well-marked granulation. In strongly granulated perfect shells (and markedly in *B. artemesia*) the granules, or certain rows of them, are regularly tipped with projecting points of epidermis which are very deciduous. The surface shown by Cooper's[1] figure 26 as belonging to *B. montezuma* is an eroded surface and bears no resemblance to the granulation exhibited by an unworn specimen. Figures 29 and 30, on the other hand, are very good and give an excellent idea of the surface of the respective species.

Now, the peculiar apex and surface above described are exhibited perfectly by *B. artemesia* when in perfect and well-developed condition, but it should be noted that the ribbing of the nepionic whorls is easily removed by wear; and a worn specimen, even when living, may have much of it lost and the worn area polished, almost as if it never had been ribbed. The granulation of the latter surface (as already mentioned), though always existent, is inconstant in strength and distribution. The granules begin to erode before the rest of the shell, owing to their prominence, and hence in worn specimens their places are often occupied by rows of punctures caused by erosion.

The peristome is usually thickened and the outer lip but little reflected. The pillar in all the specimens I have seen is nearly straight and in none of them is the axis in the least pervious. Behind the reflected pillar lip is a chink or umbilical fissure which varies in size in different individuals. The last whorl is often peripherally appressed and usually a little attenuated in front, features greatly exaggerated in "*Columna*" *ramentosa*. Now, Dr. Cooper tells us that his "*Columna*"

[1] Cooper, Proc. Cal. Acad. Sci., 2 ser., V, No. 4, pl. VI.

ramentosa abbreviata has the apex, surface, and general form of *B. artemesia*, but with a gyrate pillar and pervious axis in the last whorl. In the only specimen I have seen of variety *abbreviata*, the axis is not pervious and the shell is pathologically distorted. I do not doubt that some of Dr. Cooper's examples of this form (of which only nine specimens were collected in two years) have a pervious axis, but I am inclined to regard the shell as a variety of *B. artemesia* rather than *C. ramentosa*, and as a peculiar pathological product rather than a normal development. I fully agree to the proposition that *B. abbreviata*, if it is normal, presents characters (analogous to the gyrate axis of *Leptobyrsus spirifer* in its penultimate whorl) in many respects intermediate between *B. artemesia* and "*Columna*" *ramentosa*, and that all three are derived from the same stock. The specimens had unfortunately been put into very strong alcohol at first and consequently had been so contracted that not only the head and associated parts, but also the anterior end of the foot had been invaginated within the general surface of the body and all attempts at relaxing them failed entirely. It was observed, however, that the body above was slaty black, with large, elongate, pustular granulation, the foot paler, bordered above and at the edge by a narrow row of shorter pustules distinct from those of the general surface. The sole was marked by a deep median groove, on each side of which, extending to the marginal border, is a broad reptary band or longitudinally striate, nearly smooth reptary surface. The tail end is somewhat rounded with no visible mucus gland; the front edge substruncate. The characters of "*Columna*" *ramentosa* were similar on a smaller scale.

The jaw of *B. artemesia* is fairly strong; the upper part smooth, the lower part with about 12 somewhat irregular ribs, smooth or low on the side toward the median line and with a thin, ragged, projecting edge outwardly. They looked as if the jaw had been repeatedly split upward from the cutting edge about half way to the upper margin, with a dull knife held obliquely. These ribs, if they can be so called, hardly project from the surface of the jaw, and contrast very strongly with the few strong distant ribs which are found on the jaw of *Rhodea*. The jaw in these Bulimuli is always reinforced by a thin chitinous sheet which protects the roof of the mouth from the points of the teeth on the radula. It is usually left off or neglected in figures of the jaw. This appendage is connected with the lower margin of insertion of the jaw proper and extends back about three or four times as far as the antero-posterior width of the jaw. It is usually smooth and almost transparent. In *B. artemesia* the anterior central part has the punctate, or rather cellular appearance of adenoid tissue, being covered with minute circular impressions or markings only visible under high magnification. If these are elevations or depressions on the surface of the sheet (which for convenience may be called the oral shield) they are probably on the side which is attached to the flesh and are perhaps due to the cellularity of the tissue they protect. (See Plate I, fig. 6.)

The jaw, on the whole, resembles that of *Thysanophora*, as figured by Pilsbry. The teeth of the radula are also of the normal bulimuloid type with about 35 laterals on each side of the rhachidian tooth. The latter is symmetrical and has the lateral cusps practically absent, though there is a shoulder on the side of the median cusp where the lateral casps are usually situated. The lateral teeth are very similar; the outermost are shorter and wider and have the inner and outer cusp more separated or less fully developed, but otherwise, as in *B. alternatus*, resemble the inner laterals. The radula as a whole differs chiefly from that of *B. alternatus* in having the individual teeth a little wider in proportion to their height.

BULIMULUS (ORTHOTOMIUM) RAMENTOSUS, Cooper.

(Plate XXXI, fig. 8.)

Rhodea californica var. *ramentosa*, COOPER, Proc. Cal. Acad. Sci., 2 ser., III, p. 102, 1891.

Columna ramentosa, COOPER, loc. cit., p. 215, 1892; p. 338, 1893.

Plicolumna ramentosa, COOPER, loc. cit., V, p. 164, June, 1895.

Near the edge of lagoons near San Jose del Cabo, Lower California, Bryant and Eisen; also in the mountains by Eisen, Vaslit, etc., but the altitude is not stated. (Cooper.)

This species has precisely the nucleus of *B. artemesia* and the external appearance of the animals as far as could be determined in the very contracted specimens does not differ. The jaw is almost exactly the same size as that of *B. artemesia*, and agrees in every particular in the mode of its construction. If a number of jaws of the two species were mixed no one could determine to which species any particular jaw properly belonged. The teeth and radula agree with equal closeness except that it is somewhat narrower, the formula being 28: 1: 28 in the specimen examined, and the outermost laterals were proportionately a little wider than in *B. artemesia*.

The distinctions between this form and *Rhodea* have been pointed out in the sectional diagnosis, but it may be as well to call attention to some minor details. The base of the last whorl in *B. ramentosus* is rounded and the constriction of the peripheral part of the whorl is variable in different specimens. It would almost seem as if the constriction and the gyration of the pillar were in some way correlated, as the pillar above the last 2 whorls is not gyrate, though somewhat tortuous, and consequently the perviousness of the axis does not extend, as supposed by Cooper, to the entire axis, but only to that part of it included in the last whorl and a half or two whorls. The columellar muscle is exceptionally long, and attached for several whorls, so that it is very difficult to withdraw the animal from its shell, even after it has been long in alcohol. The axis appears to be destitute of any lamellæ, plications, or projections of any kind. In fact, the creature, so far as its shell is concerned, is a very attenuated *Leptobyrsus* with its gyrate axis continued into the adult state, whereas in the ordinary

Leptobyrsus the gyration ceased in time for the pillar of the completed shell to appear normally straight and the axis impervious. In a perfectly adult *B. rumentosus* the margins of the aperture are expanded and slightly thickened, but not reflected. The diameter of the hollow axis varies in different specimens.

Family GLANDINIDÆ.

Genus PSEUDOSUBULINA, Strebel and Pfeffer.

PSEUDOSUBULINA EISENIANA, Cooper.

It has already been shown by Strebel and Pfeffer (1882) that some of the small Mexican species with a shell closely resembling *Stenogyra* and *Spiraxis* are destitute of a jaw and have a dentition closely resembling that of *Glandina*. These were separated under the name of *Pseudosubulina*, with a longitudinally ribbed *Stenogyra*-like shell having a smooth nuclear portion and a truncate pillar (Ex. *P. chiapensis*, Pfeffer). To this group a subgenus was added under the name of *Volutaxis*, distinguished by having axially ribbed nuclear whorls and the pillar not truncate, but slightly thickened and twisted, and passing more or less directly into the sharp-edged peristome. The species described by Dr. Cooper, under the provisional name of *Melaniella* (*tastensis* and *M. eiseniana*, the latter being sinistral), are almost exactly intermediate between the typical *Pseudosubulina* and *Volutaxis*, indicating that the two groups should be consolidated. In these two species the nuclear whorls, when perfect, are delicately axially ribbed; the young shells have a straight pillar, not truncate, but with an angle at the base which, in the adult, is more or less obsolete, while the pillar becomes not plicate, but somewhat thickened.

In *P. eiseniana* there is no jaw. The animal is pale colored, and was so contracted in the specimens that the existence of labial palpi, of which there was no evidence, could not be absolutely denied. It is, however, probable that there are none. The very minute radula is of the shape of the same organ in *Glandina*, oval, with the rows of teeth meeting at a sharp angle in the median line. There are about 13 slender, arched, needle-like teeth on each side of a very small, low, slender, narrow rhachidian. Some of the laterals appeared to have a double cusp, which may have been pathological; in general they resembled the laterals of *Glandina*, but had the cusps more drawn out, slender, and relatively about twice as long compared with the base.

Genus STREPTOSTYLA, Shuttleworth.

STREPTOSTYLA NEBULOSA, new species.

(Plate XXXIII, fig. 4.)

Shell of a brilliant yellowish brown, clouded irregularly with opaque blotches, thin, ovoid, with $5\frac{1}{2}$ whorls; nucleus smooth, the apex blunt,

the second whorl wider between the sutures than the third; surface of the shell polished, with the incremental lines occasionally and irregularly conspicuous; spire short, the suture deep and channeled, but narrow; base slightly attenuated, pillar with its edge thickened, twisted, and slightly reflected; outer lip thin, sharp, nearly straight. Length 22, maximum diameter, 10 mm.

Found inside of a large Helix at San Cristobal, Chiapas, Mexico, by E. W. Nelson. No. 107369, U.S.N.M.

This species is nearest to *S. bocourti*, Crosse and Fischer, but has a more oval form, less pointed and less elevated spire.

Family SUCCINEIDÆ.

Genus SUCCINEA, Draparnaud.

SUCCINEA LUTEOLA, Gould.

Specimens of what appears to be this species were found sparingly at Lake Palomas in the Mimbres Valley, northern Mexico, near boundary monument No. 19, and in the drift of the Santa Cruz River at Tucson, Arizona. It is also abundant at Fort Clark, Texas.

LIST OF THE KNOWN PULMONATE FAUNA.

The following list of land mollusks belonging to the Central region includes all that are known to inhabit it south of latitude 42° to the Mexican border. North of about that parallel there are various intruders, and the Sonoran element of the fauna is excluded by the climate. The region south of the boundary is too insufficiently known to take into consideration. Those species which are marked with an asterisk (*) are relatively northern, and not known south of the locality following the name. Those marked with a dagger (†) belong to the mountain tops of the warmer region about the boundary line, and are probably all found south of the line some distance into Sonora and Chihuahua, the border States of Mexico. The northernmost locality of some of them which are not known north of the boundary follows the name. The fresh-water species, on account of having a different distribution from the land pulmonates, are here omitted; also the border species of Texas and Lower California, which are not known to enter the region indicated.[1]

Family VITRINIDÆ.

† *Vitrina pfeifferi*, Newcomb. Fort Wingate, New Mexico; Jemez Sulphur Springs, Ashmun.

* *Vitrina limpida*, Gould. Colorado (Ingersoll); New Mexico.

[1] I am indebted to Dr. V. Sterki for assistance in making up the list of *Pupa* and *Vertigo*.

Family ZONITIDÆ.

* *Vitrea arborea*, Say. Rio Chama, New Mexico; Arizona.
* *Vitrea radiatula*, Aldee. Arizona; New Mexico.
* *Vitrea minuscula*, Binney. Northward from Yucatan; Arizona.
* *Vitrea* (*Glyphyalinia*) *indentata*, Say. Mountains of Lower California and New Mexico.
* *Vitrea* (*Glyphyalinia?*) *subrupicola*, Dall. Clinton's Cave, Utah.
* *Conulus fulvus*, Draparnaud. New Mexico.

Family ENDODONTIDÆ.

Patula strigosa, Gould. North to Wyoming and Idaho from Sonora.
Patula strigosa var. *concentrata*, Dall. New Mexico and Arizona.
Patula hemphillii, Newcomb. Arizona to Idaho.
Pyramidula cronkhitei, Newcomb. Nevada and California.
* *Pyramidula striatella*, Anthony. Fly Park, Arizona; White Oaks, New Mexico, Ashmun.
* *Helicodiscus lineatus*, Say. Rio Chama and White Oaks, New Mexico.

Family HELICIDÆ.

Thysanophora ingersollii, Bland. Fly Park, Arizona; New Mexico.
Thysanophora hornii, Gabb. Yaqui River, Mexico; Arizona.
Polygyra levettei, Bland. New Mexico; Arizona.
Polygyra levettei var. *Thomsoniana*, Ancey. Santa Fé, New Mexico.
† *Polygyra mearnsii*, Dall. Arizona and New Mexico.
† *Polygyra chiricahuana*, Dall. Arizona.
† *Polygyra ashmuni*, Dall. New Mexico.
† *Polygyra pseudodonta*, Dall. New Mexico.
* *Epiphragmophora indioensis*, Yates. Indio, California.
Epiphragmophora roweliii, Newcomb. Phœnix, Arizona.
† *Epiphragmophora magdalenensis*, Stearns. Mexico to California.
Epiphragmophora coloradoënsis, Stearns. Grand Canyon, Colorado.
Epiphragmophora arizonensis, Dall. Tucson, Arizona.
† *Epiphragmophora hachitana*, Dall. Southwestern New Mexico to Lower California.
* *Vallonia costata*, Müller. San Marcial, New Mexico.
* *Vallonia pulchella*, Müller. Rio La Plata, Colorado.
* *Vallonia cyclophorella*, Ancey. Arizona to Idaho; New Mexico.
* *Vallonia gracilicosta*, Reinhardt. Arizona to Dakota.

Family LIMACIDÆ.

Limax montanus, Ingersoll. Colorado.
Limax campestris. Binney. Nevada.

Family PHILOMYCIDÆ.

† *Philomycus sallei*, Crosse and Fischer. Sonora and Lower California.

Family BULIMULIDÆ.

* *Cionella lubrica*, Müller. Arizona; Venezuela.
† *Bulimulus nigromontanus*, Dall. Sonora, Mexico.
† *Bulimulus baileyi*, Dall. Sonora, Mexico.

Family PUPIDÆ.

† *Holospira* (*Haplostemma*) *mearnsii*, Dall. New Mexico.
Holospira (*Eudistemma*) *arizonensis*, Stearns. Arizona.
† *Holospira* (*Distomospira*) *bilamellata*, Dall. New Mexico.
† *Metastoma coahuilensis*, Binney. Coahuila, Mexico.
† *Metastoma semisculpta*, Stearns. Chihuahua, Mexico.
Metastoma pfeifferi, Menke. Sonora, Mexico.
Metastoma rémondii, Gabb. Sonora, Mexico.
† *Metastoma crossei*, Dall. New Mexico.
* *Pupa fallax*, Say. Arizona, New Mexico, and northward (*P. arizonensis*, Gabb).
* *Pupa muscorum*, Linné. Arizona (Palmer).
* *Pupa blandii*, Morse. Colorado; New Mexico (Ashmun).
* *Pupa syngenes*, Pilsbry. New Mexico; Arizona to Montana.
Pupa gabbii, Dall. New Mexico, Arizona (= *P. arizonensis*, W. G. Binney, non Gabb).
Pupa hordacea, Gabb. Fort Grant, Arizona, to Texas.
* *Pupa procera*, Gould. New Mexico to Texas; Minnesota to Rhode Island.
* *Pupa armifera*, Say. New Mexico (Ashmun).
Pupa hordeacella, Pilsbry. Arizona to Florida.
* *Pupa holzingeri*, Sterki. New Mexico to Manitoba.
Pupa pilsbryana, Sterki. New Mexico; Arizona.
* *Pupa pentodon*, Say. Nevada; Texas.
* *Sphyradium edentulum*, Draparnaud. Colorado; Europe.
Sphyradium edentulum var. *alticola*, Ingersoll. Colorado.
* *Vertigo corpulenta*, Morse. Nevada; Colorado.
* *Vertigo decora*, Gould. Colorado to Alaska (+ *P. ingersollii*, Ancey, + *P. coloradoensis*, Cockerell).
Vertigo decora var. *concinnula*, Cockerell. Colorado.
* *Vertigo binneyana*, Sterki. New Mexico to Manitoba.
* *Vertigo ovata*, Say. New Mexico; Arizona to Montana.
* *Vertigo ventricosa*, Morse, var. Arizona.
* *Vertigo tridentata*, Wolf. Arizona to Montana, etc.
* *Vertigo milium*, Gould. New Mexico (fossil).

Family SUCCINEIDÆ.

* *Succinea lineata*, Binney. Sonora to Fort Union, Nebraska.
* *Succinea rusticana*, Gould. Nevada.
* *Succinea nuttalliana*, Lea. Salt Lake City, Utah.
* *Succinea sillimani*, Bland. Nevada.
* *Succinea stretchiana*, Bland. Nevada.
Succinea luteola, Gould. New Mexico; Texas.

The reader will note what a very large number of species of this list are small and extend from a more congenial habitat in more northern regions along the mountain ranges into this hot and dry region. Doubtless there are many species to be discovered yet by those who are ready to brave rattlesnakes by turning over fragments of volcanic rocks on the sun-scorched mountains near the boundary; and especially by those who may be fortunate enough to be there during the infrequent rains, when these animals for a time lose their timidity and venture abroad. Especially among the Holospiras may new forms be looked for, as they are remarkably similar to one another externally and are usually found in large numbers where they occur at all. Not until the fauna of

northern Mexico is well known, will it be possible to generalize correctly on the geographical distribution of the mollusks of this region and the extent to which different elements are represented in the fauna of the boundary.

For a long time peculiarities in the distribution of the land mollusks of this and adjacent regions have suggested to the writer that during the Oligocene the highlands of northern Mexico were separated from the mainland of North America by an arm of the sea. It is certain that the peninsula of Lower California was so separated, and the separation may have persisted until even more recent times. The existence of comparatively fresh marine shells, fossil in the sands of the desert far to the eastward of the Colorado, and the fact that the height of land or watershed between the Colorado and the Rio Grande is at present only 3,000 or 4,000 feet above the sea, while the evidences of volcanic activity are abundant—all these facts give color to the hypothesis, which requires fuller and more exact investigation for its establishment. If such a barrier has not been interposed, it is difficult to account for the failure of the land-shell fauna of western Texas to make a distinct impression on that of the boundary region, and to find reasons why the genus *Epiphragmophora* should have failed to extend its range to the eastward of the Mexican uplift. But this problem is for the future to solve, and we may rest content with having stated it.

FRESH-WATER SPECIES.

Genus LIMNÆA, Lamarck.

LIMNÆA BULIMOIDES, Lea.

Found sparingly at Fort Worth, Texas, and in the Rio Grande near El Paso, Texas.

LIMNÆA DESIDIOSA, Say.

A few very slender specimens with elongated spires were found in the drift of the Santa Cruz River, Tucson, Arizona, by Dr. Mearns. Also at San Rafael, New Mexico; Ashmund.

Genus PHYSA, Draparnaud.

PHYSA MEXICANA, Philippi.

Collected by Dr. Mearns at Fort Worth and Fort Clark, Texas; in the Guadalupe Canyon, and San Bernardino River, New Mexico; at Lake Palomas, in the Mimbres Valley, Mexico; from Seven Wells, the Colorado River, and the Santa Cruz River near Tucson, Arizona; at Laguna, 20 miles north of Campo, and at Cameron's ranch, San Diego County, California. Some strongly shouldered specimens in a subfossil state, from the Colorado desert, are perhaps a variety of this species, which is extremely variable.

Genus APLEXA, Fleming.

APLEXA HYPNORUM, Linnæus.

A single specimen of this species was found in the drift of the Santa Cruz River, near Tucson, Arizona, by Dr. Mearns. This is the most southerly locality yet reported for this species, about the identification of which there seems to be no doubt. The Santa Cruz is a tributary of the Gila River.

Genus PLANORBIS, Guettard.

PLANORBIS LIEBMANNII, Dunker.

A single specimen was received from 20 miles north of Campo, San Diego County, California.

PLANORBIS TUMIDUS, Pfeiffer.

Specimens of this species were sent in by Dr. Mearns from Las Moras Creek, Kinney County, Texas, and the Rio Grande River, near El Paso; from Seven Wells, the Santa Cruz River near Tucson, San Bernardino River, and the Colorado River at Yuma, Arizona; from the San Bernardino River and Sonoyta River, northern Mexico, near the boundary line; near monument No. 219; in Gardner's Laguna, Lower California, and at Laguna Station, New River, San Diego County, California.

This species varies enormously. Some of the specimens are less elevated, with a wider umbilicus and one whorl more than others of the same size, and taken separately would be regarded as distinct, but the intermediate gradations are so numerous that I am unable to regard them as forming a different species or even a really constant variety.

Genus BYTHINELLA, Moquin Tandon.

The following species has been kindly determined by Mr. Pilsbry, who has made a special study of this genus.

BYTHINELLA PALOMASENSIS, Pilsbry.

(Plate XXXI, fig. 9.)

Bythinella palomasensis, PILSBRY, Nautilus, IX, p. 68, Oct., 1895.

Shell small, ovate, rapidly tapering above from the periphery of the body whorl to a blunt apex; composed of 4 very convex whorls, the last about five-sixths the entire length of the shell, well rounded out; surface showing only faint incremental lines; aperture ovate, subangular above, its longest axis about half the length of the shell; peristome thin, continuous across the parietal wall and nearly straight there, though not appressed to the body whorl; umbilicus minutely perforate; color whitish corneous and somewhat translucent. Height of shell 2.75, maximum diameter 1.80, longer axis of aperture 1.36 mm.

Two specimens from Lake Palomas, northeastern Mexico, collected by Dr. Mearns. No. 130016, U.S.N.M.

One of the specimens has the latter third of the last whorl free from the body, as in *Lyogyrus*, a somewhat common pathologic condition in species of this and allied genera, but in the other and evidently normal specimen the peristome is quite free from the adjacent body whorl, not appressed thereto. Neither example retained the operculum or dried soft parts, and therefore the generic reference can not be verified by examination of the dentition, but the form of the shell is that of a *Bythinella* rather than an *Amnicola*. It is a stumpier shell than *B. binneyi*, Tryon, and has far less inflated whorls than *B. brevissima*, Pilsbry, but these two, among United States species, are conchologically its nearest allies. Of the short-spired Mexican forms *Amnicola orizabensis*, Crosse and Fischer,[1] is totally diverse, although the figures in their work look somewhat like this species. *A. guatemalensis*, Crosse and Fischer, is larger, with a relatively smaller aperture [Pilsbry].

Genus SPHÆRIUM, Scopoli.

SPHÆRIUM SOLIDULUM, Prime.

Numerous specimens of this species were obtained in Arizona from the San Bernardino River.

Genus PISIDIUM, Pfeiffer.

PISIDIUM COMPRESSUM, Prime.

Collected by Dr. Mearns in the San Bernardino River, Arizona, and Lake Palomas, south of the boundary line in the Mimbres Valley, northeastern Mexico.

PISIDIUM ABDITUM, Haldeman.

San Rafael, New Mexico; Ashmun.

Genus UNIO, Retzius.

The notes upon this group and *Anodonta* are by Mr. Charles T. Simpson, of the United States National Museum.

UNIO COUCHIANUS, Lea.

Unio couchianus, LEA, Journ. Acad. Nat. Sci., IV, p. 371; Obs. on the Genus Unio, VIII, p. 53, pl. LXVI, fig. 196.

This rare species was described by Dr. Lea from half a dozen odd valves sent to him by the Smithsonian Institution, which were procured by Lieut. D. N. Couch, U. S. A., from Dr. Berlandier's collection. The shell has the general form of an inflated *U. asperrimus*, but is much less tuberculate. Dr. Lea describes it as smooth, but a careful examination

[1] Plate L, figs. 4a, 4b.

shows the surface, especially near the beaks, to be covered with slight pustules, which in the types are worn, and the valves have the radiating wrinkles on the posterior slope common to the species of the *Asperrimus* group.

Dr. Mearns procured a single right valve of what I believe is the young of this species. It is in a better state of preservation than Lea's specimens, and exhibits quite distinct, scattered tubercles.

UNIO UNDULATUS, Barnes.

Unio undulatus, BARNES, Am. Journ. of Science, VI, p. 120, pl. II, fig. 2.
Unio laticostatus, LEA, Trans. Am. Phil. Soc., X, pl. I, fig. 2; Obs. on the Genus Unio, IV, p. 42, pl. I, fig. 2.

A single, badly broken, and much worn right valve of what is no doubt this species was obtained in Kinney County, Texas. *Unio laticostatus*, though sometimes more delicately and evenly plicate than *Unio undulatus*, is undoubtedly a mere variation of Barnes' species.

UNIO POPEI, Lea.

Unio popei, LEA, Journ. Acad. Nat. Sci., IV, p. 372; Obs. on the Genus Unio, VIII, p. 54.

The types of this species came from Devils River, Texas, and the Rio Salado, New Leon, Mexico. Since the time of publication it has been rediscovered in both the typical localities by the Biological Expedition of the United States Department of Agriculture. Dr. Mearns obtained numerous valves in tolerably fair condition from Kinney County, Texas.

This, with *Unio poeyanus*, Lea, a closely allied form from Mexico, forms a small group which does not seem to be very closely related to the Unione fauna of Texas, but rather belongs to that of Mexico and Central America; and the two species are evidently closely allied in their somewhat sulcate sculpture and delicate, soft, lurid nacre, to the group typified by *Unio rowelli* of Lake Nicaragua.

UNIO MITCHELLI, Simpson.

(Plate XXXII, figs. 1-3.)

Unio mitchelli, SIMPSON, Proc. U. S. Nat. Mus., XVIII, p. 5, 1895.

Shell rhomboid-oval, solid, rather inflated, rounded before, somewhat biangulate behind; dorsal margin curved; base slightly rounded or straight, or sometimes a little emarginate; growth lines strong, irregular anteriorly; ligament rather large and prominent; epidermis coarse, often shining, varying from light yellowish brown to black; beaks fairly prominent, showing slight traces of concentric and rather strong, corrugated sculpture; cardinal teeth rather strong, short, and stumpy, slightly ragged; laterals short, heavy, and club-shaped, covered with granular sculpture which has a tendency in very solid shells to become

vertical; anterior adductor scar small and deep, posterior round and well impressed; palleal line well defined; nacre a soft, silvery white.

Length of type 55, height 33, diameter 20 mm.

Guadalupe River, Victoria County, Texas, J. D. Mitchell.

This species, which was first sent to the National Museum by Mr. Mitchell, taken at the above locality, has since been received from Mr. J. A. Singley from the Guadalupe River at New Braunfels, and from the United States Agricultural Exploring Expedition from the Rio Salado, New Leon, Mexico; and in all there are now in the collection fourteen specimens. The species varies greatly in size and considerably in form, the Mexican shell being 92 mm. in length by 55 mm. in height. Young specimens show faint traces of dark rays in the middle of the shell, and some individuals have slight traces of pustules.

In other shells there are very slight plications on the disk and on the posterior slope. Two specimens from the Guadalupe River in Victoria County are much shorter and wider, and are lighter colored than the rest, and recall *Unio aureus* to some extent. The species probably groups with *Unio rowelli* and *scamnatus*, though no other members of the group have pustules or plications.

Genus ANODONTA, Bruguière.

ANODONTA DEJECTA, Lewis.

(Plate XXXII, figs. 4, 5.)

Anodonta dejecta, LEWIS, Field and Forest, August and September, Nos. 2 and 3, 1875, p. 26.

Anodonta mearnsiana, SIMPSON, Nautilus, VI, No. 12, April, 1893, p. 134.

This species was described by Dr. Lewis, but not figured, in Field and Forest. It was brought with the material of the expedition under Lieut. George M. Wheeler west of the one-hundredth meridian, and was said to have been collected by Dr. H. C. Yarrow, naturalist of the expedition, in the Arkansas River or its tributaries. The types were placed in the National Museum, but by some accident were put away with a lot of rubbish.

When Dr. Mearns sent the shell from San Bernardino ranch the writer could not identify it with anything and concluded that it was new and named it in honor of its discoverer. Subsequently in going over and arranging the entire naiad collection of the National Museum, I found Lewis' types, and saw at once that his species and my *mearnsiana* were the same. Lewis' types consist of a pair and a left valve, all considerably broken and somewhat distorted, yet from their peculiar form, the color of the nacre and epidermis, and the texture of the shell, there can be no doubt of the identity of the two.

Though differing much in appearance from *Anodonta angulata*, Lea, the two species are closely related—a fact that would never be suspected if it were not that intermediate specimens almost connect the two. Certain specimens of *A. angulata* are almost entirely destitute

of the strong, sharp ridge on the posterior slope, which is usually characteristic of that species. They are more compressed and thinner in texture, and are much like *A. dejecta* in the lurid color of the nacre, general texture, and color of the epidermis, as well as the beak sculpture; and the soft parts of the two are much alike.

Hemphill states[1] that *Anodonta angulata* burrows in beds of compact sand and gravel in the Snake River, with the smaller end of the shell downward, and the angular solid end level with the surface, and no doubt this thickening of the shell and the prominent ridge tend to strengthen it against the shocks of the current. The thinner and more compressed specimens of *A. angulata* probably live in less rapid water, and Dr. Mearns found *A. dejecta* in soft mud.

The following is a description of *A. dejecta*, prepared from a large number of individuals:

Shell rhomboid or rhomboid-oval, sometimes slightly alate, compressed anteriorly, gradually becoming inflated posteriorly, smooth and shining, with numerous lightly marked growth lines, moderately solid; having a thin epidermis which easily wears off in exposed places, varying from bright green to brownish and pale yellow, sometimes broadly and faintly rayed in the posterior region; beaks rather compressed, sculptured with a half dozen or more wavy, concentric sulcations; nacre soft, lurid, brownish or purplish in the cavity of the shell, shading to lighter color at the edges.

Length of an average specimen 80, height 45, diameter 22 mm.

San Bernardino ranch, Mexican boundary, Arizona.

This species was found by Dr. Mearns in the following additional localities: Tucson, Arizona; Colorado River, near the Mexican boundary; Santa Cruz River, near Tucson, Arizona; San Bernardino River, Mexican boundary; New River, Laguna Station, San Diego County, California; mouth of Colorado River.

ANODONTA CALIFORNIENSIS, Lea.

Anodonta californiensis, LEA, Trans. Am. Phil. Soc., X, pl. XXV, fig. 45; Observations on the Genus Unio, V, p. 42, pl. XXV, fig. XLVII.

Specimens of what are perhaps this species, but which are too much worn to be determined with certainty, were found at monument 219, Mexican boundary line, and at New River, Laguna Station, San Diego County, California. These were merely bleached valves, generally without any epidermis, and in some cases lacking a part or all of the outer shell layer. Wherever the beak sculpture remained it was shown to be much finer and to have more numerous sulcations than that of *A. dejecta*, and in this respect it is like that of *A. californiensis*. The two species evidently approach closely, and I believe the group typified by *Anodonta angulata* to be nearly related to that of which *A. californiensis* is a member.

[1] Zoe, I, No. II, p. 326.

Summary.—The collections made by the Commission in the Central region cover thirty-nine species and varieties, of which seven belong strictly to the Mexican fauna, as far as yet known. Twenty-four of these are land shells, of which half are new, and one new *Unio* belonging to the same general region brings the number of new species up to twelve. Doubtless a thorough examination made during a rainy period would add several species to this list, but considering the circumstances under which the collection was made, and the arid and unfavorable character of the region, it would seem that Dr. Mearns met with unexpected success. As a whole, omitting species of universal range, it would seem that the land-shell fauna represents a northward extension of the mountain fauna of Mexico, rather than a modification of the molluscan life of regions north, west, or east of the territory explored. So little is known of the Mexican mollusks that extended comparisons can not at present be made. Only two of the land shells are common to other regions than Mexico and the south central basin west of the Atlantic drainage, a fact which emphasizes the insular character of the mountain tops and the faunal distinctness of their population.

SPECIES OF THE TEXAN REGION.

The following species belonging to the Texan region of the Eastern fauna were collected by Dr. Mearns:

GLANDINA TEXASIANA, Pfeiffer.

A few dead specimens at Fort Clark, Kinney County, Texas.

BULIMULUS DEALBATUS, Say.

Numerous, mostly dead specimens, Fort Clark.

BULIMULUS DEALBATUS RAGSDALEI, Pilsbry.

This small and strongly striated variety of *B. dealbatus* was as common at Fort Clark as the normal form with which numerous intermediate specimens completely unite it, though extreme specimens seem very distinct.

POLYGYRA THYROIDES, Say.

Immature specimens feeding on the leaves of *Phaseolus*.

POLYGYRA TEXASIANA, Moricand.

Found at Fort Clark and Fort Worth abundantly, the range of the species, so far recorded, extending from Fort Gibson, Indian Territory, south and west to the State of Tamaulipas, Mexico.

POLYGYRA (MESODON) ROEMERI, Pfeiffer.

A single specimen at Fort Worth.

SUCCINEA LUTEOLA, Gould.

Numerous specimens were sent from Fort Worth, others from Lake Palomas, Mexico, and the drift of the Santa Cruz River at Tucson, Arizona, this being a species common to the two regions.

HELICINA ORBICULATA, Say.

Abundant, dead, at Fort Clark and Fort Worth.

SPECIES OF THE CALIFORNIAN REGION.

The following land and fresh-water shells were collected in San Diego County, California, or just below the boundary line on the Lower Californian side, or on San Clemente Island off the coast.

SELENITES VOYANA, Newcomb.

A single dead and broken specimen was obtained near El Nido.

EPIPHRAGMOPHORA TUDICULATA, W. G. Binney.

Two dead specimens were obtained at El Nido, others in the Nachoguero Valley, Lower California, and a specimen verging toward the variety *cypreophila*, Newcomb, at San Diego.

EPIPHRAGMOPHORA PANDORÆ var. BENITOSENSIS, Pilsbry.

Los Benitos Islands, Lower California.

EPIPHRAGMOPHORA ARNHEIMI, Dall.

Arionta californiensis, Lea, var. *ramentosa*, Gould (small var.), W. G. Binney, Bull. U. S. Nat. Mus., XXVIII, p. 133, fig. 108 (2 views), 1885.
Epiphragmophora arnheimi, Dall, Proc. U. S. Nat. Mus., XVIII, p. 6, 1895.

Small island in marshes of San Pablo Bay, J. S. Arnheim (33675); San Pablo, Contra Costa County, California, A. W. Crawford (12320) and Stearns (58502); Nachoguero Valley, Dr. Mearns (128949). Type, No. 39612, U.S.N.M.

This small species has been referred to *californiensis* as a subvariety, and, in the collection, has found a place as a variety of *arrosa* or *exarata*, with which it has little affinity. A series of forty-three specimens, collected at different times and by different people, indicates very uniform size (max. diam. 18, min. diam. 15, alt. 11 mm.); the whorls range from 5 to 5½; the suture is deep, the umbilicus deep and subcylindric; the lip not much reflected, but in adults unusually thick for the size of the shell, especially near the pillar, and the deposit when fresh is of a pinkish tint; the brown band is narrow, the paler margin not conspicuous, and the suture revolves at its lower edge. The sculpture is entirely different from that of *ramentosa*, which has the granulations obliquely spaced by ungranulated intervals, forming a distinct pattern, and is

besides a much larger shell. In *E. arnheimi* the nucleus is punctate, as in *ramentosa*, and followed by close-set striæ in harmony with the lines of growth, the intervals between which are like elevated threads, the surface of which is broken into low pustules which become more close-set and elongate as the shell grows; the earlier ones are rounded and rather sparse, the later ones are irregularly disposed along the threads, the intervals between them having no regularity and not forming oblique channels or a pattern but tending to arrange themselves, so far as they are arranged at all, in horizontally revolving lines.

I have no doubt that this shell is distinct from either *ramentosa* or *exarata* and have named it for Mr. J. S. Arnheim, of San Francisco, California, by whom the majority of specimens seen were collected.

EPIPHRAGMOPHORA KELLETTII, Forbes.

Monument No. 258, on the boundary line, also at Campo and Ocean Beach, San Diego County, and the San Ysidro ranch, Lower California.

EPIPHRAGMOPHORA INTERCISA, Binney.

San Clemente Island.

EPIPHRAGMOPHORA STEARNSIANA, Gabb.

San Clemente Island; Colorado Islands.

EPIPHRAGMOPHORA GABBI, Newcomb.

San Clemente Island.

GLYPTOSTOMA NEWBERRYANUM, Binney.

Nachoguero Valley, and Campo, San Diego County.

MELAMPUS OLIVACEUS, Carpenter.

La Jolla, near San Diego.

PHYSA HUMEROSA, Gould.

Subfossil near monument No. 219.

AMNICOLA PROTEA, Gould.

Subfossil with the last.

MARINE MOLLUSKS.

As the termination of the boundary line is at the Pacific Ocean, Dr. Mearns was able to collect a number of marine species on the shore, and others during a visit to San Clemente Island, which lies west from the shore of San Diego County, about 60 miles in the Pacific, forming the southernmost of the Santa Barbara group of islands. Those to which no locality is appended were obtained at the end of the boundary line just south of San Diego.

Acmæa mitra, Eschscholtz. Ocean Beach.
Acmæa persona, Eschscholtz. Ocean Beach and La Jolla.
Acmæa patina, Eschscholtz. La Jolla.
Acmæa pelta, Eschscholtz. San Clemente.
Acmæa scabra, Nuttall. San Clemente.
Astralium undosum, Wood. San Clemente.
Bittium quadrifilatum, Carpenter. Ocean Beach.
Bulla nebulosa, Gould. San Diego Bay.
Calliostoma gemmulatum, Carpenter. Ocean Beach.
Cardium biangulatum, Sowerby. San Clemente.
Cardium substriatum, Conrad. Ocean Beach.
Cerithidea sacrata, Gould. Ocean Beach.
Chama exogyra, Conrad. Ocean Beach.
Chama pellucida, Sowerby. Ocean Beach.
Chlorostoma aureotinctum, Forbes. San Clemente.
Chlorostoma funebrale, A. Adams. Ocean Beach.
Chlorostoma fuscescens, Philippi. Ocean Beach.
Chlorostoma gallina, Forbes. San Clemente.
Conus californicus, Hinds. San Clemente, Ocean Beach, etc.
Crepidula adunca, Sowerby. Ocean Beach.
Crepidula rugosa, Nuttall. Ocean Beach.
Crucibulum spinosum, Sowerby. Ocean Beach.
Cryptomya californica, Conrad. La Jolla.
Cumingia californica, Conrad. La Jolla.
Cypræa spadicea, Gray. San Clemente.
Donax californicus, Conrad. Ocean Beach.
Drillia mœsta, Carpenter. Ocean Beach.
Erato vitellina, Hinds. Ocean Beach.
Fissurella volcano, Reeve. La Jolla.
Glyphis murina, Carpenter. San Clemente.
Haliotis cracherodii, Leach. San Clemente.
Haliotis fulgens, Philippi. San Clemente.
Haliotis rufescens, Swainson. La Jolla.
Hipponyx tumens, Carpenter. La Jolla.
Litorina planaxis, Nuttall. La Jolla, Ocean Beach, etc.
Lucapina crenulata, Sowerby. San Clemente.
Lucina californica, Conrad. San Clemente.
Macoma nasuta, Conrad. San Clemente.
Monoceros engonatum, Conrad. San Clemente.
Mopalia muscosa, Gould. San Clemente.
Muricidea incisa, Broderip. San Clemente.
Mytilus californicus, Conrad. La Jolla, etc.
Nassa fossata, Gould. Ocean Beach.
Nassa mendica, Gould (pl. XXXIII, figs. 3 and 9). Ocean Beach.
Nassa perpinguis, Hinds. Ocean Beach.
Nassa tegula, Reeve. San Clemente.
Norrisia norrisii, Sowerby. San Clemente, etc.
Olivella baetica, Carpenter. Ocean Beach.
Olivella biplicata, Sowerby. Ocean Beach and San Clemente. Also on the top of the Huachuca Mountains, Arizona, where it had been doubtless carried by Indians and used in some of their religious rites.
Pecten æquicostatus, Carpenter. San Diego Bay, etc.
Pecten latiauritus, Conrad. La Jolla.
Psammobia rubroradiata, Conrad. San Clemente.
Purpura ostrina, Gould. San Clemente.

Ranella californica, Hinds. San Clemente.
Sanguinolaria nuttallii, Conrad. La Jolla.
Saxidomus aratus, Gould. La Jolla.
Scurria (*Lottia*) *gigantea*, Gray. La Jolla, Guadalupe Island, San Clemente, etc. Some of these specimens, especially from the islands, were of remarkably large size.
Semele pulchra, Sowerby. Ocean Beach.
Semele rubropicta, Dall. Ocean Beach.
Semele rupium, Sowerby. La Jolla.
Septifer bifurcatus, Conrad. La Jolla.
Tapes staminea, Conrad. La Jolla.
Tellina bodegensis, Hinds. La Jolla.
Terebratalia transversa, Sowerby, var. *caurina*, Gould. Ocean Beach.
Tivela crassatelloides, Conrad. Mouth of the Colorado River and also on the Pacific. Fresh specimens of this species were found near Tucson, where they had probably been brought by Indians who use marine shells in some of their religious rites.
Tresus nuttallii, Conrad. Ocean Beach.
Turritella goniostoma, Valenciennes. Ensenada.

It may be noted that marine shells in a subfossil but rather fresh condition, sometimes even containing the ligament, occur toward the edge of the lowlands until the ranges east of Tucson, Arizona, are reached. These are probably Post-Pliocene and evidences of the eastward extension of the sea, which, at a comparatively recent geological epoch, almost insulated Mexico from the continent north of it. A discussion of the points involved has been omitted, as they will be discussed by Dr. Mearns in his report on the natural history work. Among the species recognized were *Solenosteira pallida*, Broderip, *Polynices* (*Neverita*) *recluziana*, Reevè, *Mulinia coloradoensis*, Dall, and *Tivela crassatelloides*, Conrad.

EXPLANATION OF PLATES.[1]

PLATE XXXI.

FIG. 1. *Holospira* (*Haplostemma*) *mearnsii*, Dall; 14.5 mm.; with profile of aperture; p. 350.
2. *Holospira* (*Metastoma*) *crossei*, Dall; 11 mm.; with profile of aperture; p. 348.
3. *Holospira* (*Distomospira*) *bilamellata*, Dall; 20.5 mm.; profile of aperture; p. 349.
4. *Holospira* (*Metastoma*) *pasonis*, Dall; 23 mm.; p. 348.
5. The same in profile.
6. Jaw of *Bulimulus* (*Leptobyrsus*) *artemesia*, Binney; greatly magnified; from camera lucida drawing by W. H. Dall; pp. 360, 362.
7. *Epiphragmophora hachitana*, Dall; front view of a rather depressed specimen; 26.5 mm.; p. 339.
8. Jaw of *Bulimulus* (*Plicolumna*) *ramentosus*, Cooper; greatly magnified; from a camera lucida sketch by W. H. Dall; p. 363.
9. *Bythinella palomasensis*, Pilsbry; 2.75 mm.; p. 369.
10. *Epiphragmophora hachitana*, Dall; basal view; major diameter, 26.5 mm.; p. 339.
11. *Epiphragmophora arizonensis*, Dall; front view; 17 mm.; p. 337.
12. The same, basal view.

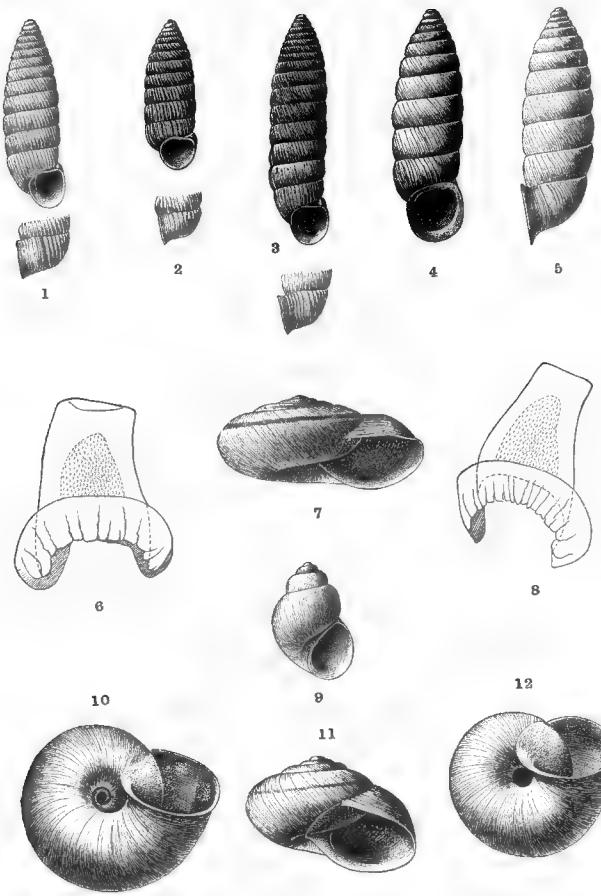
[1] The actual length in millimeters of the specimen figured follows the reference in each case.

PLATE XXXII.

FIG. 1. Inside view of right valve of *Unio mitchelli*, Simpson; 54 mm. long; p. 371.
2. Dorsal view of the same.
3. External view of left valve.
4. *Anodonta dejecta*, Lewis; dorsal view of specimen, 75 mm. long; p. 372.
5. The same, side view.
6. *Bulimulus artemesia*, W. G. Binney; a large worn specimen, not showing spiral sculpture; 31 mm. long; p. 360.
7. *Polygyra mearnsii*, Dall; front view; 13 mm.; p. 343.
8. The same from above.
9. *Polygyra chiricahuana*, Dall; front view, 18 mm.; p. 341.
10. The same from above.
11. *Polygyra mearnsii;* basal view; p. 343.
12. *Polygyra chiricahuana*, Dall; basal view, p. 341.

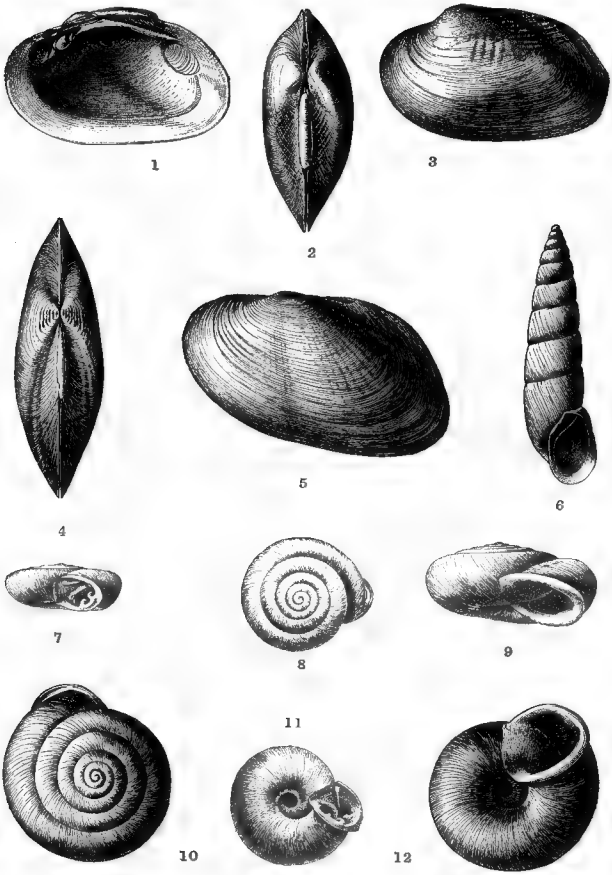
PLATE XXXIII.

FIG. 1. *Coelocentrum pfefferi*, Dall; 43 mm.; p. 352.
2. *Coelocentrum pfefferi*, Dall; view of base, same enlargement; p. 352.
3. *Nassa mendica*, Gould; slender southern form; No. 46634, U.S.N.M.; p. 377; compare fig. 9.
4. *Streptostyla nebulosa*, Dall; 22 mm.; p. 364.
5. *Coelocentrum nelsoni*, Dall; 53 mm.; p. 352.
6. *Coelocentrum nelsoni*, Dall; view of the base, same enlargement; p. 352.
7. *Anisospira strebeli*, Dall; showing adult decollate shell, with the portion of the spire which is dropped; 29 and 21 mm.; p. 353.
8. *Anisospira strebeli*, Dall; view of base, same enlargement; p. 353.
9. *Nassa mendica*, Gould, var. *cooperi* Forbes, a strongly ribbed form; No. 46636, U.S.N.M.; p. 377.



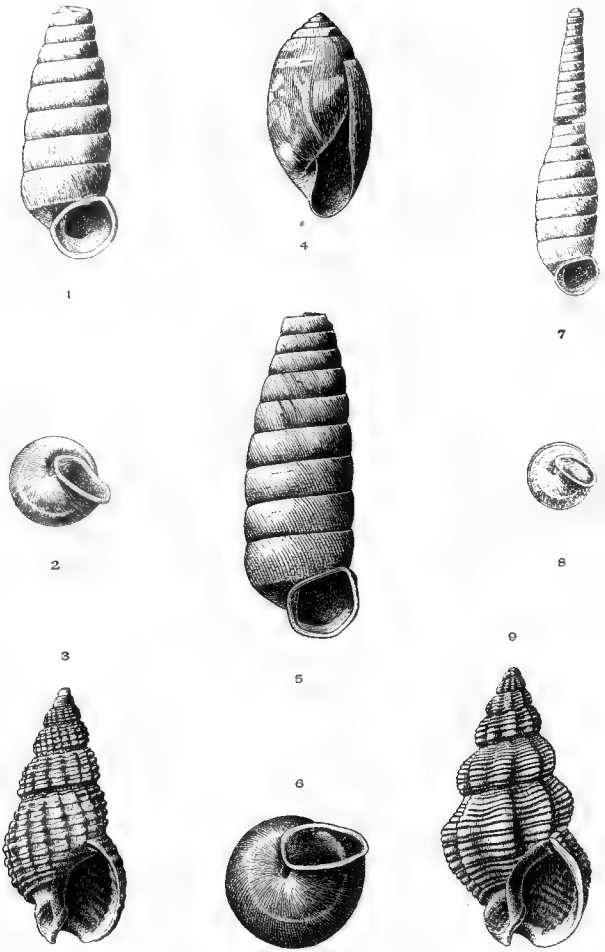
SHELLS OF THE MEXICAN BOUNDARY.

FOR EXPLANATION OF PLATE SEE PAGE 378.



SHELLS OF THE MEXICAN BOUNDARY.

FOR EXPLANATION OF PLATE SEE PAGE 379.



SHELLS OF THE MEXICAN BOUNDARY.

FOR EXPLANATION OF PLATE SEE PAGE 379.

NOTES ON FISHES COLLECTED IN KAMCHATKA AND JAPAN BY LEONHARD STEJNEGER AND NICOLAI A. GREBNITSKI, WITH A DESCRIPTION OF A NEW BLENNY.

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The Kamchatkan fishes mentioned in this article were obtained in the fall of 1883. A small collection was secured by Mr. Grebnitski at Yesso, Japan, in 1894, and one of these species is here described as new to science and as a representative of a new genus.

For purposes of comparison reference is also made to a specimen of *Lumpenus medius* from Plover Bay, Siberia, collected by Dall and Bean in 1880 and mentioned in the published account of their fishes under the name *Lumpenus fabricii*. Attention is called to the close similarity of *Cottus taeniopterus*, Kner, with *C. platycephalus*, Pallas; it is possible that the two are identical. The *Lumpenus fabricii* of Kröyer appears to agree fully with the *L. anguillaris* of Pallas. It may be found, as suggested in this paper, that *Muræenoides maxillaris*, Bean, is identical with *M. taenia*, Pallas.

Another interesting fact shown by this collection is the great variability in the number of dorsal spines in *Opisthocentrus;* and the redescription of the white-spotted *Salvelinus* of Kamchatka will be welcome to students of the Salmonidæ.

CLUPEA PALLASII, Cuvier & Valenciennes.

No. 33812, U.S.N.M. (2613). Petropaulski, September 24, 1883; L. Stejneger. From the inner harbor.

No. 38994, U.S.N.M. Avatcha Bay, Kamchatka, September, 1883; N. Grebnitski. One example.

No. 38995, U.S.N.M. Avatcha Bay, September, 1883; N. Grebnitski. Two specimens.

SALVELINUS LEUCOMÆNIS (Pallas).

No. 33814, U.S.N.M. (2612). Petropaulski, September 24, 1883; L. Stejneger.

This species has the hyoids feebly developed. Similar in form to *S. malma*, but with a less elongate and stouter body. The length of the head is about equal to the height of the body, and is contained $4\frac{1}{2}$ to $4\frac{3}{4}$ times in the total length without caudal. The eye is two-thirds as long as the snout; it equals about one-half the width of interorbital space, and is contained $5\frac{1}{8}$ times in the length of the head. The maxilla extends to or beyond the vertical through the hind margin of the orbit, the upper jaw being nearly one-half as long as the head. Lower jaw slightly shorter than the upper. Scales small, about 36 in a transverse series from the origin of the dorsal to the lateral line; 195 rows in the lateral line, 122 of which bear pores.

All the fins short; dorsal nearly midway between tip of snout and root of upper caudal lobe, its base nearly as long as longest ray, half as long as the head; its upper margin very slightly concave; last ray one-half as long as the longest. The adipose fin is placed over the end of the anal, its width about equal to one-half its length, which is about equal to the length of the eye. The length of the pectoral is contained from 7 to $7\frac{1}{2}$ times in the total without caudal. The ventral is placed under the middle of the dorsal; it does not nearly reach to the vent; its length is about one-half that of the head. Ventral appendage minute in some specimens, in others nearly as long as the eye. The caudal is emarginate, its middle rays, measured from the end of the scales, one-half as long as the outer. The anal is scarcely concave when expanded.

Pyloric cœca 22; branchiostegals 12. Gill-rakers 6+10, the longest less than one-half length of eye.

Color bluish gray above, whitish below; the sides with numerous large white spots, some of which are two-thirds as long as the eye.

Four individuals were obtained in the inner harbor by Dr. Stejneger among the herrings. He says it is called Kundscha.

No. 38998, U.S.N.M., is a specimen 9 inches long, collected at Petropaulski in September, 1883, by N. Grebnitski, who says it is called Chaiko.

ONCORHYNCHUS CHOUICHA (Walbaum), Jordan and Gilbert.

A skin preserved in salt was in the collection of Dr. Stejneger. From Petropaulski.

ONCORHYNCHUS KETA (Walbaum), Gill and Jordan.

No. 33804, U.S.N.M. (2625). Saranna, Kamchatka, September, 1883; L. Stejneger. Spent female.

ONCORHYNCHUS KISUTCH (Walbaum), Jordan and Gilbert.

No. 33815, U.S.N.M. (2611). Petropaulski, September 24, 1883; L. Stejneger. Four specimens, 5½ to 6 inches long. Anal rays developed, 13–14; branchiostegals 12–13; pyloric cœca 66. "Miakischa, inner harbor, among the herrings."—(Stejneger.)

HYPOMESUS OLIDUS (Pallas), Günther.

No. 33809, U.S.N.M. (2617). Petropaulski, Kamchatka, September 24, 1883; L. Stejneger. D. 10; A. i, 14; scales 62.

No. 38977, U.S.N.M. Petropaulski, August, 1883; N. Grebnitski.

OSMERUS DENTEX, Steindachner.

No. 33808, U.S.N.M. (2617). Petropaulski, September 24, 1883; L. Stejneger.

No. 33874, U.S.N.M. (2705). Avatcha Bay, September 27, 1883; L. Stejneger. Young. D. 11; A. i, 15; P. 14; V. 8; scales 68. Length of specimen, 1⅞ inches.

No. 38996, U.S.N.M. Petropaulski, August, 1883; N. Grebnitski. Three examples.

HEXAGRAMMUS ASPER, Steller.

No. 38991, U.S.N.M. Petropaulski, August, 1883; N. Grebnitski. D. XXIII, 21; A. 24; scales 103.

No. 33857, U.S.N.M. (2586). Petropaulski, September 17, 1883; L. Stejneger. Three young individuals ranging from 96 to 115 mm. in length. D. XX, 21; A. 24; scales 103 in the largest. D. XXII, 22 in another. The upper lateral line ends under the middle of the spinous dorsal in all.

No. 33811, U.S.N.M. (2618). Petropaulski, September 24, 1883; L. Stejneger.

No. 47557, U.S.N. M. Petropaulski; L. Stejneger. One young example, 3§ inches long.

HEXAGRAMMUS DECAGRAMMUS, Pallas.

No. 38993, U.S.N.M. Petropaulski; N. Grebnitski. D. XXI, 24; A. 23; scales 109.

HEXAGRAMMUS ORDINATUS, Cope.

No. 33866, U.S.N.M. (2585). Petropaulski, September 17, 1883; L. Stejneger.

Length of the specimen, 87 mm.; D. XIX, 26; A. 25; lateral line 95. The lateral line, which begins at the throat and ends at the origin of the ventral, sends a branch on each side obliquely upward, ending usually under the middle of the pectoral. Although this branch is variable in length, it is one of the characteristics of the species. The anal has seven and the ventral two black cross bands; a black blotch somewhat

larger than the pupil a little above the base of the pectoral, just below the lateral line.

No. 33854, U.S.N.M. (2704). Avatcha Bay, September 27, 1883; L. Stejneger.

Two young specimens, 69 and 73 mm. long. The larger one of these has, in addition to the short branch running up toward the pectoral, a short line immediately in front of the ventral origin not extending as far forward as the one on the middle line of the throat. The smaller example is normal, except that the line on the ridge of the throat is not continued forward far from the origin of the ventral.

COTTUS PLATYCEPHALUS, Pallas.[1]

No. 38982, U.S.N.M. Petropaulski, September, 1883; N. Grebnitski. D. IX, 16; A. 13. Vomerine patch of teeth greatly developed.

COTTUS TÆNIOPTERUS, Kner.

No. 47558, U.S.N.M. Petropaulski, Kamchatka; L. Stejneger.

Length, $3\frac{5}{8}$ inches. Eye nearly equal to snout, $4\frac{2}{3}$ in head. Head two-fifths of length without caudal. Interorbital space about two-thirds eye. Pectoral reaches to anal origin; the ventral nearly to vent. The longest preopercular spine is a little longer than eye. The maxilla reaches nearly to the hind margin of the eye.

D. VIII, 15; A. 13; lateral pores, 37.

Cottus tæniopterus should be carefully compared with *C. platycephalus*, Pallas; the two are closely related and may prove to be identical.

COTTUS NIGER, Bean.

No. 33844, U.S.N.M. (2589). Petropaulski, September 17, 1883; L. Stejneger.

No. 33879, U.S.N.M. (2590). Petropaulski, September 17, 1883; L. Stejneger. D. IX, 15; A. 11.

COTTUS POLYACANTHOCEPHALUS, Pallas.

No. 33816, U.S.N.M. (2616). Petropaulski, September 24, 1883; L. Stejneger.

ENOPHRYS DICERAUS (Pallas), Jordan and Gilbert.

No. 33817, U.S.N.M. (2614). Petropaulski, September 24, 1883; L. Stejneger.

No. 33852, U.S.N.M. (2686). Avatcha Bay, Kamchatka, September 27, 1883; L. Stejneger. An individual 3 inches long. D. VIII, 12; A. 11.

No. 38978, U.S.N.M. Petropaulski, August, 1883; N. Grebnitski. A male in breeding dress; the anal papilla much enlarged.

GYMNACANTHUS PISTILLIGER (Pallas), Gill.

No. 33807, U.S.N.M. (2615). Petropaulski, September 24, 1883; L. Stejneger. From the inner harbor.

[1] ? = *C. decastrensis*, Kner.

LIPARIS GIBBA, Bean.

No. 38974, U.S.N.M. Petropaulski, September, 1883; N. Grebnitski. Length of specimen, 8¼ inches. D. 46; A. 36.

The width of the mouth over the extremity of the maxillaries slightly exceeds the length of the eye and snout combined, and is considerably more than one-half length of head. The eye is one-half as long as the snout, equaling one-sixth length of head, and nearly one-half interorbital space. The maxilla extends almost to the vertical through the front margin of the eye. The teeth are in very broad bands in the jaws; blunt conical.

The depth of the gill opening is contained 2⅓ times in length of head; the distance between the lower ends of the gill opening equals the length of the head without the snout. The front margin of the ventral disk is almost directly beneath the hind margin of the eye. The width of the disk equals its length, which is nearly equal to the postorbital length of the head. Thirteen papillæ form an outer circle around nine smaller papillæ, which are in the center of the disk. Each of the papillæ of the outer row has a brown spot in the center, except the anterior one which has two of these spots. The lower portion of the pectoral is procurrent on each side, the two portions separated at their origin by a very narrow interspace only about half the length of eye. The pectoral, when extended, reaches almost to the origin of the anal; it is very large, the width of its base equaling the length of the head without snout. The longest pectoral ray is about three-fourths as long as the head. The distance of the dorsal origin from the tip of the snout is contained 3¼ times in the total length without caudal. The greatest depth of the body, at the pectorals, is almost equal to the length of the head and slightly exceeds one-fourth of the total length without caudal. The caudal is connate with the dorsal and anal; its length equals that of the head without the snout, and slightly more than one-sixth of the standard body length.

The color in spirits is grayish, much mottled with large, pale areas. The same peculiarities of marking are found on the pectorals. The fish may have been purplish in life. It was taken from a depth of 18 fathoms.

BRACHYOPSIS ROSTRATUS (Tilesius), Gill.

No. 47569, U.S.N.M. Yesso, Japan; N. Grebnitski.

Measurements of Brachyopsis rostratus.

	Inches.		Inches.
Length of specimen	8¼	Eye	0 7/8
Length of head	1½	Interorbital space	0 7/8
Length of snout	0⅔	Maxilla length	0 7/8
Body depth	0⅔	Pectoral length	1⅓
Body width	0⅔	Ventral length	0⅔

First dorsal from snout, 2⅝ inches; anal from snout, 3½ inches. The mandible extends to below middle of eye.

D. VIII, 8; A. 13; lateral line, 42.

SIPHAGONUS BARBATUS, Steindachner.

Siphagonus barbatus, STEINDACHNER, Ich. Beitr., V, 1876, p. 140.

No. 33858, U.S.N.M. (2587). Petropaulski, Kamchatka, September 17, 1883; L. Stejneger.

No. 38977, U.S.N.M. Petropaulski, August, 1883; N. Grebnitski; sixteen specimens.

LUMPENUS ANGUILLARIS (Pallas), Gill.

No. 38959, U.S.N.M. Petropaulski, September, 1883; N. Grebnitski; one specimen; length, 105 mm.

D. LXVI; A. 45; V. I, 3. No teeth on vomer; palatines apparently present, but doubtfully made out. The head is contained 5⅔ the depth 10 times, in length to base of caudal. The eye is placed high; its long diameter is equal to the length of the snout and one-fourth the length of head. The lower jaw is distinctly shorter than the upper. Mouth small and narrow; the maxilla reaches to below the front of the eye. The interorbital space is very narrow, scarcely two-thirds as long as the eye. The pectoral fin is nearly as long as the head, reaching to below the thirteenth spine of the dorsal. Ventral very slender, two-fifths as long as head. The vent is under the twenty-third spine of the dorsal, much nearer the tip of the snout than the base of the tail. The caudal is long and tapering, nearly as long as the head without the snout. The dorsal and anal fins are low; the anterior spines of the dorsal graduated, the longest spine one-third length of head. The anal fin is not quite so high as the dorsal. The gill-rakers are short and stout, less than half as long as the eye, 12 below the angle on the first arch. There are about 206 rows of scales on the body.

In spirits the ground color is pale olive-brown. The body is profusely mottled with irregular dusky mottlings, most distinct along the middle line and close to the ridge of the back. The caudal fin is also mottled in its anterior half. The pectorals, ventrals, and anal are pale.

Another example, No. 27575, U.S.N.M., collected in Plover Bay, Siberia, by Capt. E. P. Herendeen, is 132 mm. long and has the dorsal LXIII; A. I, 40; V. I, 3. In this example the mottlings are absent from the dorsal fin, but otherwise the color is similar to that of the specimen above described.

The palatine teeth are very weak and easily rubbed off, but can be determined with certainty. The lower jaw is included as in the other specimen. Branchiostegals, 6. The gill membranes are united at the isthmus without free posterior border; the angle is very deep, so that the distance from its apex to the root of the ventrals equals two-fifths the length of the head. The spinous dorsal begins immediately

over the posterior edge of the opercular flap, and the first six or seven rays are regularly graduated, the first being much shorter than the pupil. The eye is as long as the snout and nearly one-fourth as long as the head. The interorbital space is very narrow, less than one-half the diameter of the eye. The vent is under the twenty-third spine of the dorsal.

The *Lumpenus fabricii* of Gaimard[1] is represented with dorsal LXIV; A. I, 41. It agrees in every respect, as far as we can make out, with the examples of *L. anguillaris*, above described. Its long, tapering caudal is perfectly distinct from the dorsal and anal. Mouth small, lower jaw short, six branchiostegals, the spinous dorsal beginning over the upper angle of the gill opening, and other characters possessed by *anguillaris* are present. The anterior spines of the dorsal are regularly graduated. The vent is under the twenty-first dorsal spine.

Color exactly as in the preceding.

LUMPENUS MEDIUS (Reinhardt), Kröyer.

No. 27544, U.S.N.M. Plover Bay, Siberia, August 13, 1880; Dall and Bean. Two specimens, 100 to 138 mm. long.

These were at first referred to *Lumpenus fabricii*, but we are now satisfied that the specimens do not belong to that species, but to *L. medius*.

The length of the larger specimen is 138 mm., of which the caudal fin equals 15 mm. The smaller example is 100 mm. long, the caudal measuring 11 mm. The caudal is long and moderately tapering, and is connate with the dorsal and anal. The jaws are equal, the maxilla extending to below the front margin of the eye. Teeth in the jaws in two rows, rather wide set, uniform in size; the teeth of the outer row of the upper jaw are larger than those of the inner row; the outer row of the lower jaw is on the lips. No teeth on the vomer; a few weak palatine teeth. Gill membranes very deeply cleft and attached to the isthmus, the distance between their point of attachment and the root of the ventral equaling one-half the length of the head.

Eye large, slightly longer than snout, $3\frac{1}{2}$ in head. Interorbital space narrow, convex, less than one-half the diameter of the eye. Lips well developed. The ventral fins originate in front of the pectoral base; they are short and slender, scarcely longer than the eye. Gill-rakers very short; 17 on the first arch. Pectorals long, with a broad base, their length nearly equal to that of the head without the snout. Width of pectoral base equals length of eye; when extended this fin reaches to below the eleventh spine of the dorsal. The vent is under the twentieth spine of the dorsal. The dorsal origin is almost directly over the top of the base of the pectoral. The anterior spines of the dorsal are regularly graduated up to about the seventh, the first spine being one-half as long as the eye, the longest spine as long as the eye. The longest anal rays equal the length of the eye. The length of the head is

[1] Voy. en Scandinavie, pl. XIV, fig. 1.

contained 5½ times in the total length to caudal base; the greatest depth of the body is nearly one-ninth of the same length, in this respect differing greatly from *L. anguillaris*.

In spirits the body is uniformly pale olivaceous. There are no traces of mottlings anywhere. The fins are all pale.

About 26 rows of scales can be counted obliquely upward and forward from the origin of the anal to the base of the dorsal, and about 50 rows between the upper angle of the gill opening and the vertical from the vent. In the smaller specimen there are about 47 rows.

ANOPLARCHUS ALECTROLOPHUS (Pallas).

No. 38960, U.S.N.M. Petropaulski, September, 1883; N. Grebnitski.

This lot contains seven specimens, varying in length from 88 to 105 mm. The crest on the head of most of the individuals is remarkably well developed, while in one or two it is very much smaller. In two of the examples the caudal is well united with the dorsal and anal. D. LXIV; A. 44.

In the example measuring 105 mm. the crest on the head is very low. D. LXIII; A. 45. This appears to be a female. One of the large specimens with a high crest is a male with the spermaries moderately developed.

PHOLIS TÆNIA (Pallas).

Blennius tænia, PALLAS, Zoog. Ross.-Asiat., III, p. 178.
? *Murænoides maxillaris*, BEAN, Proc. U. S. Nat. Mus., IV, 1882, p. 147.

B. aculeis jugularibus, corpore longissimo fasciato, cauda subdistincta. Hunc sub eodem nomine ex insulis Curilorum missum accepi quondam.

Descr.—Spithamalis, forma Tæniæ, maxillæ *dentibus* osseis subdistinctis obtusiusculis. *Caput* compressum operculis planis, subtriangularibus; *membrana* branchiostega quadriradiata. *Corpus* ensiforme, squamulis minimis, cuti innatis sparsum. *Anus* in medio longitudinis. *Pinna dorsalis* ab ipso capite ad caudam, radiis osseis, intra cutem spinescentibus 87 subæqualibus. *P. ani* radiis 47 apice mollioribus, flexis, ab ano itidem ad caudam. *Cauda* subdistincta. P. pectorales parvæ, et loco ventralium spinæ duo osseæ recurvatæ, communi ossiculo fultæ, jugulares, sub ipsis p. pectoralibus. (Pallas.)

A specimen, No. 38966, U.S.N.M., was collected at Petropaulski in August, 1883, by N. Grebnitski. It is 165 mm. long. D. LXXXIX; A. II, 44.

The height of the body is contained eight times in the total without caudal, the length of the head nine times. The eye is one-fifth as long as the head. The maxilla is one-fourth as long as the head and extends to below the front of the pupil. The mouth is very oblique. The mandible is two-fifths as long as the head. Pectoral nearly one-half length of head. Ventral small, two-thirds length of eye.

The distance of the dorsal origin from tip of snout equals length of

head. The vent is under the forty-second dorsal spine. The caudal contains 17 or 18 rays, and is connate with the dorsal and anal fins.

A narrow, dark band from each eye around the throat, continued on the interorbital space by narrower dark lines inclosing a diamond-shaped pale area between the eyes. Pale bands in front of and behind the eye continued over the top of the head, the hinder one as broad as the eye in its widest portion and bounded behind by a narrow, dark line. Fourteen or 15 broad, dark bands on the sides alternating with saddle-shaped markings on the back and dorsal fin, the widest bands nearly one-half length of head. The markings become indistinct posteriorly.

The type of *Muraenoides maxillaris* was destroyed in 1883, and the published description is now the only means of comparison with *M. tænia*. The differences observed are too important to be passed over without notice. The length of the maxilla in *M. maxillaris* equals one-half the distance from the tip of the snout to the dorsal origin (one-third in *tænia*); the mandible is as long as the pectoral in *maxillaris* (about two-thirds as long in *tænia*). It may be found that a series of specimens from St. Paul Island will establish the identity of *maxillaris* with *tænia*.

A smaller example, No. 38967, U.S.N.M., was obtained by N. Grebnitski at Petropaulski, in September, 1883. Length, 74 mm. This has alternating dark and light bands on the sides, about 18 to 20 of each. The tops of some of the light bands on the dorsal fin inclose a brown blotch as in *maxillaris*. D. LXXXVIII; A. II, 44.

PHOLIS RUBERRIMUS (Cuvier and Valenciennes).

No. 47568, U.S.N.M. Five specimens. Yesso, Japan, July, 1894; N. Grebnitski. D. 92; A. 50 (the largest). Length from 5 to 8 inches. These are from Volcano Bay, Port Mororan.

The pink color is not fixed, but comes off upon the hands and the muslin wrappings.

PHOLIS NEBULOSUS (Schlegel).

No. 47566, U.S.N.M. (47567). Yesso, Japan; N. Grebnitski. D. LXIII; A. II, 42 (?). Length, 6⅝ to 7⅝ inches.

PHOLIDAPUS, new genus.

(Plate XXXIV.)

Body and tail as in *Pholis*, but shorter and deeper; head small, compressed, naked, provided with numerous mucous pores; anterior nostrils narrow slits, posterior nostrils tubular; mouth small, oblique; intermaxillary teeth in two rows, blunt conical, the last one on each side of the outer row enlarged, canine like; mandibulary teeth conical, moderately sharp-pointed, uniserial; no teeth on vomer or palate; upper

jaw very slightly protractile. Gill membranes broadly united, free from the isthmus. Scales very small, cycloid, with concentric striæ; no lateral line.

Dorsal fin as in *Pholis*, beginning over the end of the head; anal long and low, composed of two very slender, short spines, and many rays; caudal rather long and rounded, barely separate from dorsal and anal; pectorals moderate, on a broad base; no ventrals. Intestinal canal slender and short, with a few pyloric cœca of unequal size.

PHOLIDAPUS GREBNITSKII, new species.

(Plate XXXIV.)

This Xiphidiine blenny strongly resembles some species of *Pholis*, but the body is deeper and shorter, and the ventrals are wanting. The species is based upon two individuals, No. 47564, U.S.N.M., from Yesso, Japan, where they were obtained by Mr. N. Grebnitski.

The specimens are 141 mm. long, including caudal; 126 mm. to base of caudal. The head (22 mm.) is equal to the greatest depth of body. The eye is slightly longer than the snout and one-fourth as long as the head. The interorbital space is narrow, two-thirds of the length of the eye.

The naked head resembles that of *Pholis;* its length is contained about 5½ times in total length without the caudal. The mouth is small and very oblique; the mandible is slightly included and has a well-developed lip. The maxilla is partly concealed under the preorbital bone; it does not quite reach to below the anterior margin of the pupil. The anterior nostril is midway between the eye and the tip of the intermaxilla. Seven mucous pores around the orbit; three on the preorbital bone. The pore in the origin of the semicircular dark band around the nape is continued backward by a series of 6 similar ones ending near the upper angle of the gill opening. A series of 10 or 11 pores beginning near the front of the chin on each side, extending backward and curving upward to the upper anterior edge of the operculum. The gill membranes are broadly united, but they are not joined to the isthmus.

The dorsal origin is over the end of the head; the fin is low, and consists of spines, the longest and strongest in the posterior third being slightly longer than the eye. The distance of the vent from the tip of the snout contains the head length 2⅔ times. The anal is slightly lower than the dorsal, the rays longest posteriorly. The caudal is rounded, and is barely separated from the dorsal and anal. The pectoral base is broad, and the fin is two-thirds as long as the head.

The intestine is slender, and is more than twice as long as the head. Stomach short, pear-shaped, with 6 slender pyloric cœca of unequal length, the longest about twice as long as the eye.

The body is completely scaled, the scales very small, cycloid, closely imbricated, with numerous concentric striæ, and they extend halfway up the membrane connecting the dorsal spines.

The general body color is brown, the sides sparsely and vaguely mottled. The pectorals are pale. A narrow, dark band extends from the middle of the eye downward and forward, a similar band running backward from the eye on the preopercle; an interrupted semicircular band from eye to eye across the nape. D. LVII; A. II, 39–40.

The species is named for Mr. N. Grebnitski, to whose industry and zeal the Museum is indebted for many valuable collections.

OPISTHOCENTRUS QUINQUEMACULATUS, Kner.

(Plate XXXV.)

Opisthocentrus quinquemaculatus, KNER, Sitzb. Ak. Wiss. Wien, LVIII, 1 Abth., June–December, 1868, pp. 340, 341, pl. VII, fig. 20.—STEINDACHNER, op. cit., LXXXII, 1 Abth., July, 1880, p. 262.

The genus *Opisthocentrus*, Kner, differs from *Centronotus* [*Murœnoides*] in its thicker body, in the flexibility and height of its dorsal rays, except the last 11 to 13, which are spiny; from *Stichœus* in lacking ventrals and also in the flexibility of the numerous anterior unarticulated dorsal rays. Jaw teeth rounded at the point. Vomerine teeth; palatines absent. (Steindachner.)

No. 38937, U.S.N.M. Petropaulski, 1883; N. Grebnitski. Two specimens, male and female. Drawn; one specimen, sex not determined.

No. 38958, U.S.N.M. Petropaulski, September, 1883; N. Grebnitski. Eight specimens.

No. 47555, U.S.N.M. Petropaulski; L. Stejneger. One specimen, 7¼ inches long, female. Dorsal 58, the last 9 or 10 being stout spines. Six black blotches on dorsal.

No. 33859, U.S.N.M. (2588). Three specimens, 3.1 to 3.6 inches long, and with the dorsal blotches varying in number from five to seven in regular gradation.

No. 33848, U.S.N.M. (2620). One specimen, 6 inches long. Petropaulski, Kamchatka, September 23, 1883. Dorsal rays 58, the last 8 stout spines. Five black spots on the dorsal.

Dr. Steindachner is justified in his remark that this species was not first taken at Pinang or Singapore, but in De Castries Bay; it is a resident of Kamchatka and the adjacent region, as the collections of Stejneger and Grebnitski will show.

OPISTHOCENTRUS QUINQUEMACULATUS, Kner (?).

No. 47565, U.S.N.M. Yesso, Japan; N. Grebnitski. D. 54, the last 15 spines; A. 38.

Length of fish to caudal base, 5⅛ inches; length of head, 1 inch; depth of body, seven-eighths of an inch; eye equal to snout, 4½ in head. Maxilla reaches to front of eye. A narrow, dark band under eye. Body with narrow, dark-brown reticulations. About seven roundish black spots on the dorsal.

The increased number of dorsal spines and greater compression of the body throw some doubt upon the identification with Kner's species.

ELEGINUS NAVAGA (Kolreuter).

No. 33810, U.S.N.M. (2582). Petropaulski, inner harbor, September 17, 1883; L. Stejneger.

No. 38899, U.S.N.M. (2584). Petropaulski, inner harbor, September 17, 1883; L. Stejneger.

POLLACHIUS CHALCOGRAMMUS (Pallas), Jordan and Gilbert.

No. 33805, U.S.N.M. (2619). Petropaulski, September 24, 1883; L. Stejneger.

PLEURONECTES GLACIALIS, Pallas.

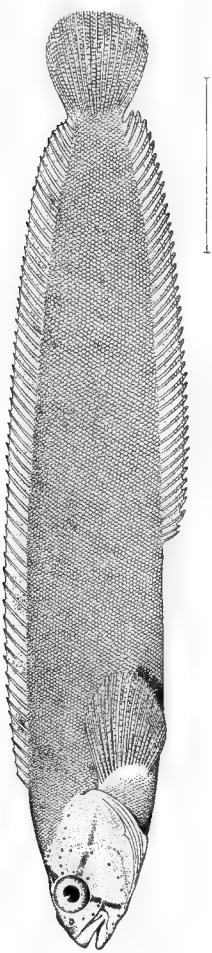
No. 33839, U.S.N.M. (2583). Petropaulski, Kamchatka, inner harbor, September 17, 1883; L. Stejneger. D. 58; A. 41.

PLEURONECTES STELLATUS, Pallas.

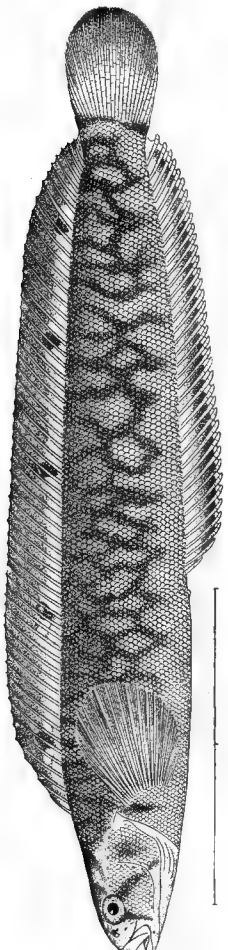
No. 33813, U.S.N.M. (2680). Avatcha Bay, Kamchatka, September 25, 1883; L. Stejneger. D. 56; A. 39.

GASTEROSTEUS PUNGITIUS BRACHYPODA, Bean.

No. 33888, U.S.N.M (2035). Petropaulski, May 16, 1883; L. Stejneger. Length, 60 mm.



PHOLIDAPUS GREBNITSKII, Bean and Bean.



OPISTHOCENTRUS QUINQUEMACULATUS, Kner.

DESCRIPTIONS OF NEW SPECIES OF NORTH AMERICAN COLEOPTERA IN THE FAMILIES CERAMBYCIDÆ AND SCARABÆIDÆ.

By MARTIN L. LINELL,
Aid, Department of Insects.

WHILE incorporating recent accessions in the collection of North American Cerambycidæ in the United States National Museum, several undescribed species were met with. For one of these, a small species from southern Texas with remarkable antennal structure, it was found necessary to erect a new genus. Two new species of Scarabæidæ are also described.

ELAPHIDION ALBOFASCIATUM, new species.

Cylindrical, robust, uniformly black, shining, sparsely clothed with rather long, mostly appressed, grayish white hairs, condensed on the middle of elytra to a straight transverse fascia. Antennæ without spines, piceous brown, very stout, shorter than the body in both sexes; first joint thick, clavate, a little longer than third; fourth shorter than third; fifth to eleventh subequal in length; third and fourth strongly, fifth slightly campanulate at apex; fifth to eleventh flattened, subangulate internally at apex. Palpi subequal; last joint triangular, obliquely truncate. Thorax slightly longer than broad, cylindrical, broadly but not strongly constricted at base, hardly constricted at apex; disk coarsely, moderately densely punctate with a shining callosity, more or less diamond-shaped, at middle and an obsolete tubercle at the sides behind the middle. Scutellum transverse, rounded, densely hairy. Elytra parallel, truncate at base, conjointly rounded at apex without spines, coarsely but not very densely punctate at base, abruptly more finely punctate behind the anterior margin of the white band and gradually smoother toward apex. The longer white hairs forming the band sometimes continue to apex, but generally the band is very distinct. Ventral surface more shining, moderately punctate; abdomen finely punctulate. Sixth ventral segment exposed, in the male corneus, deeply concave with margin rounded, in the female membranous, truncate. Legs short, moderately stout, coarsely and densely punctate.

Tarsi broad, parallel; first joint of the posterior pair slightly longer than second and third together. Length, 14 mm.

Type.—No. 202, U.S.N.M.

Of this handsome, strikingly distinct species twenty examples were collected by Mr. D. W. Coquillett in the mouth of July in the foothills bordering Mohave Desert on the south, Los Angeles County, California. It resembles *E. mœstum*, Le Conte, but may be at once distinguished by the unarmed antennæ, the coarser white vestiture, and the elytral fascia.

Genus PIEZOCERA, Serville.

Lacordaire's group Piezocerides is closely allied to Ibionides, differing only by the serrate antennæ. The principal generic characters of *Piezocera* are the strongly compressed tibiæ and the flattened antennal tubercles, separated on the front only by a fine, impressed line. Four or five tropical American species are described, and one, *P. monochroa*, Bates, from Almalonga, Mexico. This latter is closely allied to the following Texan species, but judging from Bates' description has a different thorax.

PIEZOCERA SERRATICOLLIS, new species.

Linear, uniformly dark castaneous, shining, sparsely covered with long erect hairs. Antennæ three-fourths the length of the body, from the third joint strongly flattened, serrate, bicarinate on both sides and with an additional short median carina at apex of each joint; third to tenth joints subequal in length, triangular, longer than broad; eleventh joint longer, obtuse at apex. Thorax twice longer than broad, broadly and strongly constricted at base, slightly concave and smooth before the constriction at middle, with an obtuse smooth tubercle each side of the concavity; disk with sparse setiferous punctures; sides broadest before the basal constriction and slightly narrowed to apex, with numerous setiferous tubercles, making the margin appear crenulate if seen from above. Elytra broader than thorax, subparallel, longitudinally impressed on the disk alongside the suture, with sparse setiferous punctures arranged subseriately; intervals nearly smooth; apices strongly obliquely truncate inward, the angles rounded. Legs sparsely hairy; femora moderately clavate, nearly smooth; tibiæ strongly compressed and carinate, with a series of coarse punctures along the exterior side; tarsi broad, short; first joint of the posterior pair one-half longer than the second. Length, 6 mm.

One example, collected by Prof. C. H. T. Townsend at Brownsville, Texas.

Type.—No. 203, U.S.N.M.

IBIDION EXCLAMATIONIS, Thomson.

Two examples of this species, previously recorded from Almalonga, Mexico, are in the National Museum, collected by Prof. C. H. T. Townsend,

at Brownsville, Texas. The genus *Ibidion*, that now enters the list of our Texan fauna, differs, according to Lacordaire, from *Compsa*, Perty, only by the carinate tibiæ. The generic character is not very distinct in this species.

IBIDION TOWNSENDI, new species.

Male.—Linear, shining, piceous brown, covered with a fine golden pubescence, dense on the prothorax and at the sides of the ventral surface, sparse on the elytra and legs and absent from the antennæ. In addition to this it has sparse long erect hairs, longest and most numerous on the six basal joints of the antennæ and on the femora. Head broader than thorax, coarsely punctate. Antennal tubercles prominent, acute. Antennæ one-half longer than the body, first joint stout, coarsely punctate, as long as the fourth; third to sixth thickened, somewhat flattened, sparsely but roughly punctate, linear, finely carinate above; third joint nearly twice longer than fourth; fifth and sixth equal, one-half longer than fourth; the five apical joints equal, filiform, pale in color. Thorax cylindrical, a little more than twice as long as broad, very finely and densely punctulate, with a smooth, raised median line, abbreviated at each end. Scutellum semicircular, densely golden pubescent. Elytra parallel, one half broader than thorax; the inflexed sides subopaque, light brown, minutely punctate; disk piceous, sparsely coarsely punctate, flattened and longitudinally impressed at basal third; equidistant from suture and margin are two elongate ivory spots, the anterior one just outside the impression at basal third, the posterior one twice shorter at apical third. Thighs strongly clavate, sparsely and minutely punctulate. Tibiæ dilated toward apex, especially the anterior ones, distinctly carinate. Length, 6.5 to 7.5 mm.

Two examples; collected June 7 and 23 at Brownsville, Texas, by Prof. C. H. T. Townsend.

Type.—No. 204, U.S.N.M.

PŒCILOBRIUM RUGOSIPENNE, new species.

Linear, cyaneous, shining, anterior femora reddish yellow. It differs from *P. chalybæum*, Le Conte, as follows: Thorax less rounded on the sides, subcylindrical, sparsely but strongly punctate. Elytra coarsely and densely rugosopunctate. Length, 4½ mm. One example from California.

Type.—No. 205, U.S.N.M.

OBRIUM MOZINNÆ, new species.

Elongate, parallel, very shining; sparsely hairy, reddish yellow, elytra, antennæ, tibiæ, and tarsi black. Head as broad as elytra, sparsely coarsely punctate each side of a smooth median space; clypeal suture deeply impressed. Antennæ a little longer than the body; first joint sparsely punctate, shining, clavate, as long as the third; third

and fourth equal, slightly incrassate toward apex, sparsely hairy; fifth to eleventh a little longer, equal, filiform, subopaque, finely pubescent. Thorax slightly longer than broad, narrower than the head, strongly constricted at base, much less constricted at apex; sides obtusely angulate between the constrictions; a deep fovea above the angle; disk with very sparse setigerous punctures. Elytra with coarse, sparse setigerous punctures, subseriately arranged; apices separately rounded. Ventral surface and femora with sparse, minute, setigerous punctures; tibiæ and tarsi with denser hairs. Length, 4 mm.

Male.—Thorax immaculate; abdomen blackish at base; fifth ventral segment with a semicircular emargination.

Female.—Thorax with a transverse black spot on disk; abdomen immaculate; second segment very broadly emarginate, semicircularly excavate, excavation filled up with a dense brush of yellow, coarse hairs; third segment broadly concave, smooth; fourth flat, semicircular, notched at apex; fifth very narrow, triangular, obtuse at apex.

Two examples, male and female, collected by Mr. E. A. Schwarz, June 5, at Brownsville, Texas, on *Mozinna spatulata*. Mr. Schwarz recognized this as an undescribed species and labeled it with the MS. name used above.

Type.—No. 206, U.S.N.M.

TETRANODUS, new genus.

Antennæ with joints third to sixth strongly incrassate and clavate; eyes coarsely granulate. In other generic characters it agrees with *Euderces* of Leconte.

Type.—*Tetranodus niveicollis*, new species.

TETRANODUS NIVEICOLLIS, new species.

Rufous, apical half of elytra, a spot behind the humeri, abdomen and tibiæ black, sparsely covered with whitish, flying hairs. Head very coarsely and densely punctate, genæ rugose. Eyes small, coarsely granulate, deeply emarginate, rounded in front, gradually attenuated behind the base of the antennæ. These latter somewhat longer than the body, finely pubescent, 11-jointed; first joint moderately stout, slightly arcuate, as long as the fifth; second joint small, a little longer than wide; third nearly twice longer than fourth, strongly clavate, rounded at apex; fourth, pyriform; fifth and sixth, subequal, each longer than fourth, oval, pedunculate; last five joints slender, seventh to tenth gradually decreasing in length, eleventh equal to tenth. Thorax more than twice longer than broad, strongly arcuate upward from the base, densely longitudinally strigose; base strongly constricted, with a transverse band of dense silvery-white hairs. Elytra, cylindrical in outline, hardly broader than thorax, convex and conjointly rounded at apex; subbasal ridge slight, obtuse; a deep transverse depression at basal third, behind which there is a strictly transverse, strongly elevated

ivory vitta, not quite reaching margin nor suture; the punctuation is sparse, but rather coarse before the ivory band, and behind it, it is finer, gradually more obsolete toward apex. The silvery band of the prothoracic peduncle is prolonged beneath on the sides of the mesosternum, and the ivory band of elytra is continued as a band of silvery hairs on the posterior part of the metasternum. Femora strongly clavate; tibiæ deeply sulcate and carinate; tarsi short. Length 4 mm.

One example, collected by Prof. C. H. T. Townsend at Brownsville, Texas, June 26, 1895.

Type.—No. 208, U.S.N.M.

It will be interesting to see if the antennal characters of this species are sexual or not, when the female is discovered. Bates has described an allied genus *Diphyrama*,[1] where the male has the third and fourth antennal joints strongly clavate and the female these joints simple but the terminal joints dilated.

LEPTURA PERNIGRA, new species.

Robust, entirely black, covered with a sparse, short, black pubescence, longer and more dense on the thorax. Dorsal surface subopaque; ventral surface and legs shining. Antennæ filiform, as long as three-fourths of the body in the male, shorter in the female; fourth joint as long as the sixth, fifth a little longer, third a little longer than fifth; last joint not appendiculate. Head less wide than the thorax; eyes large, prominent; vertex slightly concave, rugosely punctate; mouth strongly produced; clypeus and labrum shining, sparsely punctate. Thorax campanulate, a little longer than wide, strongly narrowed at apex, deeply constricted at base, strongly rounded at the sides; posterior angles wanting; median line obsoletely depressed, smooth at base; disk densely but not confluently, moderately coarsely punctate. Elytra at base much broader than thorax, slightly narrowed from the base; apices slightly dehiscent, obliquely truncate, broadly emarginate with angles acute; punctuation slightly less coarse than on the thorax, very dense but not confluent at the base, more dispersed and muricate toward apex; ventral surface densely punctate; middle of the last three abdominal segments sparsely and finely punctulate, in the female nearly smooth. Length, 10 to 10.5 mm.

Male.—Last ventral segment broadly concave, apical margin broadly rounded.

Eleven males and two females collected on Wilsons Peak, Los Angeles County, California, in June by Mr. D. W. Coquillett.

Type.—No. 207, U.S.N.M.

This very distinct species should take its place in the group *L. sanguinea* of LeConte. From the equally black male of *L. lætifica*, LeConte,

[1] Trans. Ent. Soc. London, 1872, p. 187.

it is distinguished at once by its robust form and globose, constricted thorax.

LEPTURA COQUILLETTI, new species.

(Group *læta* of LeConte.)

Moderately robust, the male as stout as the largest females of *L. tribalteata*, LeConte, the female as the male of *L. nitens*, Forster. Antennæ entirely black, filiform, as long as three-fourths of the body in the male, considerably shorter in the female. Head (except mouth and antennæ), prothorax, pectus, and abdomen densely covered with golden pubescence, entirely concealing the black surface, at least in the female. No black hairs on the disk of prothorax, as in *L. tribalteata*. Thorax deeply channeled along the base, strongly constricted at the sides behind the middle; posterior angles distinctly prolonged (as in *L. tribalteata*); disk densely punctate in the female, less densely in the male. Elytra somewhat rounded at the sides, finely punctate; the apices very obliquely truncate with the angles acute; four transverse, nearly straight, very broad, yellow bands; the basal one covering the epipleura and including a black humeral spot that arcuately connects with the black suture; the second yellow band slightly broader at the suture; three bands, narrower than the yellow ones, and apex black; the whole surface, even the black parts, covered with sparse, golden pubescence. Legs in the female yellow with tips of tarsi infuscate, in the male fuscous with base of tibiæ testaceous. Length, 10 to 12 mm.

Male.—Last ventral segment longer than broad, convex, with a small triangular impression and a slight notch at apical margin.

Female.—Last ventral segment broader than long, broadly concave, slightly emarginate at apex.

Two males and five females collected (June and July) on Wilsons Peak (4,000 feet altitude), Los Angeles County, California, by Mr. D. W Coquillett.

Type.—No. 209, U.S.N.M.

This elegant species has the form of a *Typocerus*, but has only slight traces of poriferous spaces on the antennæ and should be placed near *Leptura tribalteata*, LeConte, from which it differs by the golden pubescence covering even the black parts and by its larger size and stouter form.

AMPHIONYCHA SUTURALIS, new species.

Cylindrical, piceous, feebly shining, clothed with a fine cinereous pubescence and with erect pale hairs, longer and more numerous above. Antennæ black, as long as the body, obsoletely annulate with white at the base of the joints. The four basal joints are slightly thickened with long black hairs scattered all over, but with a tendency to form a fimbria on the inferior surface. The relative length of the joints as in *A. flammata*, Newman; the third joint the longest, the scape and fourth joint subequal, nearly twice as long as the fifth; the fifth to

eleventh are slender, filiform, slightly decreasing in length toward apex. Head rufous, densely rufopubescent, convex, slightly impressed between the antennæ, with a finely impressed median line; a piceous spot on the occiput and another one behind the eye each side. Thorax pale rufous, densely rufopubescent, slightly wider than long, feebly rounded at the sides; a broad median line piceous, sparsely but deeply punctate. Elytra moderately punctate, separately rounded at apex; suture narrowly, and side margins more broadly, rufous with short rufous pubescence. Ventral surface uniformly piceous, more shining. Length, 7.5 to 8 mm.

Four examples collected by Prof. C. H. T. Townsend at Brownsville, Texas.

Type.—No. 210, U.S.N.M.

This species is not an *Amphionycha* in the sense this generic name is used by European authors, but it is congeneric with *flammata*, Newman, and must follow that species, whatever it may ultimately be called. Of the numerous allied genera from Central and South America, they seem to agree best with the characters given for *Erana* of Bates, but the third antennal joint in our species is but slightly longer than the scape.

METHIA MORMONA, new species.

Linear, opaque, piceous, rugosely punctate and sparsely pubescent. Antennæ twice as long as the body; scape much shorter than the third joint, clavate, transversely rugose, without any trace of cicatrix; second joint very short; third to eleventh slightly decreasing in length, the eleventh about three-fifths as long as the third. Antennal tubercles transverse, obtuse. Eyes separated above by a narrow channel, prolonged on the front, which is longitudinally concave. Thorax longer than broad, slightly constricted at each end, rounded on the sides at middle, with an arcuate callosity in front of scutellum. Elytra parallel, truncate at base, conjointly broadly rounded at apex, reaching the tip of abdomen; sides inflexed at basal half; epipleura wanting; disk flattened with three longitudinal raised lines, abbreviated behind; color testaceous with suture, side margins, a large stripe from the humeral umbone and apex black; between the raised lines are traces of brown stripes behind the middle. Ventral surface slightly shining, finely punctate. Abdomen cylindrical; last ventral segment deeply emarginate (male). Legs slender, coarsely pubescent; tarsi with the first joint as long as second and third together; fourth joint very slender, as long as the first. Length, 10 mm.

Four examples were collected at Salt Lake City, Utah, by Mr. Th. Roser, of the Marist College, Brookland, District of Columbia, one of which he kindly presented to the National Museum.

Type.—No. 211, U.S.N.M.

This species differs from *Methia*, as defined by Newman and LeConte, by the visible second antennal joint and in the length of elytra and

terminal joint of antennæ, but I prefer at present to leave it in thi genus.

DIPLOTAXIS BREVISETOSA, new species.

Ovate, convex, rufoferruginous or rufopiceous, shining, sparsely pubescent with very short semierect setæ. Head convex, sparsely but coarsely and deeply punctate; clypeal suture obliterated except a short groove at the eye. Clypeus more densely punctate, rounded, slightly truncate at apex, with margin distinctly reflexed, antennæ 10-jointed, ferruginous. Palpi ferruginous. Thorax nearly twice broader than long, broadest at middle (in *D. puberulus* and *popino* the thorax is broadest behind the middle), slightly narrowed to base, arcuately narrowed to apex; all the angles rectangular; apex somewhat narrower than the base, truncate, with a membranous margin; base arcuate at middle; disk moderately densely and deeply punctate. Scutellum semioval, with a few punctures at base, smooth at apex. Elytra at base hardly broader than thorax, slightly wider posteriorly; costæ not very distinct, each with a series of punctures; intervals with slightly larger punctures of the same size as on thorax, subseriately arranged at the sides. Pygidium deeply punctate. Thorax beneath densely and coarsely punctate. Abdomen nearly smooth at middle, coarsely punctate at the sides. Legs sparsely punctate and hairy. Anterior tibiæ tridentate, the two apical teeth strong, the upper one small. Claws cleft at apex; the inferior part nearly as long as the superior, oblique at apex. Length, 6.5 to 7.5 mm.

Six examples from Brighton, Nueces County, Texas.

Type.—No. 212, U.S.N.M.

Of the hairy species of *Diplotaxis*, the *sordida* of Say, is large (11 mm.) and has the anterior thoracic angles acuminate; *D. puberulus*, LeConte, is elongate and has the anterior thoracic angles obtuse, and *D. popino*, Casey, has truncate and angulate clypeus. All of these species have longer hairs. *D. cribulosa*, LeConte, is described as having short hairs, but the head is densely punctate and the clypeal suture impressed.

COPRIS MŒCHUS, LeConte.

A specimen of this species, previously recorded only from Texas, was collected at Los Angeles, California, by Dr. W. J. Karlsioe (November, 1891).

LACHNOSTERNA KARLSIOEI, new species.

(Group *fusca* of Horn.)

Robust, oblong, parallel, rufopiceous, very shining. Clypeus very wide, distinctly emarginate, sparsely punctate; margin moderately reflexed; front more densely punctate. Thorax broadest at base, arcuately narrowed to apex; margin very indistinctly crenulate; surface moderately coarsely, not very densely, punctate; punctures umbilicate;

median line indistinct. Elytra rather coarsely and rugosely punctate, the costæ evident. Pygidium as long as broad, oval at apex, coarsely and sparsely punctate. Metasternum with dense long hairs. Abdomen finely punctulate, sparsely along the middle. Claws strongly curvate, with a strong median tooth. Last joint of maxillary palpi ovate, not impressed. Length, 25 mm.

Male.—Antennæ wanting in the type. Abdomen flattened along the middle; penultimate segment near the margin with a strong, nearly straight ridge, widely overhanging the whole length; last segment sparsely granulate, with a rounded, shallow fovea. Posterior tibiæ with the inner spur slightly curvate, two-thirds the length of the outer one. Claspers intermediate in shape between those of *L. grandis* and *L. ulkei*, but differ from both in having an obtuse angulation on the inner side of each branch near the base.

Female.—Antennal club small, shorter than the funicle. Last ventral broadly emarginate. Pubic process deeply cleft as in *L. ulkei*, but the plates are differently shaped, the superior ones not folded.

Two examples, male and female, collected at electric light in Hot Springs, Arkansas, by Doctor W. J. Karlsioe, and kindly presented to the National Museum.

Type.—No. 213, U.S.N.M.

This magnificent species, second in size only to *L. grandior*, Linell, differs at first sight from *L. grandis*, Smith, by wanting the smooth coriaceous surface, and from *L. ulkei*, Smith, by its much finer punctuation. It comes very near *L. quadrata*, Smith, but the clypeus is distinctly emarginate. In color it is darker than *L. hornii*, Smith. A number of Lachnosternas were collected at the same locality by Doctor Karlsioe; among others, large series of *L. prunina*, *L. grandis* (including individuals with the thorax strongly sinuate before the posterior angles), and a large black variety of *L. arcuata*.

REPORT ON THE FISHES DREDGED IN DEEP WATER NEAR THE HAWAIIAN ISLANDS, WITH DESCRIPTIONS AND FIGURES OF TWENTY-THREE NEW SPECIES.

By CHARLES HENRY GILBERT,
and
FRANK CRAMER.

THE MATERIAL forming the basis of this report was secured by the United States Fish Commission steamer *Albatross* in December, 1891, while engaged in surveying a cable route between California and Honolulu. Eight hauls were made with the beam trawl in Kaiwi Channel, Hawaiian Islands, at depths of 295 to 375 fathoms. The fishes obtained are of extreme interest, all but five of the twenty-six species secured being undescribed. Most remarkable among them is *Pelecanichthys*, a new generic type of deep-sea flounder, with distensible gular pouch. Two species are included which were obtained in the same locality by the use of the surface tow net.

The following is a list of dredging stations, with names of species secured at each. Additional data concerning stations can be found in the report of the United States Commissioner of Fish and Fisheries.[1]

STATION 3467.

[Depth, 310 fathoms.]

Promyllantor alcocki.
Diaphus urolampus.
Myctophum fibulatum.
Hymenocephalus antrœus.
Malthopsis mitriger.

The two specimens of *Chimæra* said to have been taken at this station[2] were not included in the material submitted to us.

STATION 3470.

[Depth, 343 fathoms.]

Dasyscopelus macrolepidotus.
Peristedion hians.
Hymenocephalus antrœus.
Chalinurus ctenomelas.
Optonurus atherodon.
Malacocephalus lævis.

[1] Report of 1892, p. 58.

[2] Report of the Commissioner, U. S. Fish and Fisheries, 1892, p. 18.

STATION 3471.

[Depth, 337 fathoms.]

Cœlocephalus acipenserinus.
Hymenocephalus antræus.
Optonurus atherodon.

STATION 3472.

[Depth, 295 fathoms.]

Diaphus urolampus.
Argyripnus ephippiatus.
Melanostoma argyreum.
Peristedion hians.
Cœlorhynchus gladius.
Chalinurus ctenomelas.
Malacocephalus lævis.
Pelecanichthys crumenalis.
Malthopsis mitriger.

The eels reported from this station[1] were not submitted to us.

STATION 3473.

[Depth, 313 fathoms.]

Sternoptyx diaphana.
Cœlorhynchus parallelus.
Cœlocephalus acipenserinus.
Macrourus ectenes.
Macrourus propinquus.

STATION 3474.

[Depth, 375 fathoms.]

Congermuræna æquorea.
Dasyscopelus macrolepidotus.
Cœlocephalus acipenserinus.
Macrourus holocentrus.
Macrourus gibber.
Trachonurus sentipellis.
Optonurus atherodon.

The *Sternoptyx* listed from this station[2] did not appear in our material.

STATION 3475.

[Depth, 351 fathoms.]

Chlorophthalmus proridens.
Cœlocephalus acipenserinus.
Macrourus propinquus.
Macrourus holocentrus.
Macrourus gibber.
Optonurus atherodon.
Malacocephalus lævis.

STATION 3476.

[Depth, 298 fathoms.]

Chlorophthalmus proridens.
Polyipnus spinosus.
Melanostoma argyreum.
Scorpæna remigera.
Peristedion hians.
Cœlocephalus acipenserinus.
Hymenocephalus antræus.
Optonurus atherodon.
Malacocephalus lævis.
Pelecanichthys crumenalis.
Malthopsis mitriger.

[1] Report of the Commissioner, U. S. Fish and Fisheries, 1892, p. 18.
[2] Loc. cit.

Family LEPTOCEPHALIDÆ.

PROMYLLANTOR ALCOCKI, new species.

(Plate XXXVI, fig. 1.)

Head 7⅛ to 7½ in total length (8½ in a young specimen), depth about 17½ to 18¼. Head and trunk much shorter than tail, about 1⅞ to 2 in the latter. Pectorals 12 to 13 rays.

Body very slender, compressed. Head about as deep as wide, tapering forward to a broad, flat snout, which is acute at tip. Snout 3¼ to 3½ in head, projecting about two-fifths to one-third of its total length beyond the tip of the lower jaw. Eye circular, very small, about 3 to 3½ in snout (3 in young), high up, its center about one-third of the distance from tip of snout to gill opening. Interorbital space about 3 in snout, a little more than eye, nearly flat. Top of head transparent, the outlines of the brain distinctly visible. Anterior nostril with a very short tube on the infero-lateral part of the snout, about midway between tip of snout and tip of lower jaw. Posterior nostril an oval opening above the anterior half of the eye. Pores on snout: a small pair immediately in front of premaxillary teeth; another larger under tip of snout; one over and one behind anterior nostril; two others above the edge of the upper lip; one behind angle of jaw. Gape of mouth scarcely reaching front of orbit. Teeth in villiform bands in both jaws, those of lower jaw in about 4 or 5 well-defined series along the sides; a large, broad band of teeth on vomer. Tongue free. Lips thin, but somewhat pendent and partly concealing the gape. Gill openings small, about 3 in snout (smaller in young), far apart, the distance between them about 4⅔ in head. Gills, 4; the rakers present, but excessively minute. Lateral line above middle of body anteriorly. No scales. The low dorsal fin begins about opposite the tip of the pectoral fin; the distance between the tip of snout and the origin of the dorsal about 5½ in the total length (6 in young). Occiput a trifle nearer front of dorsal than tip of snout. The very low anal fin begins immediately behind the vent. Pectorals very small, pointed, a little shorter than the snout.

Color (in alcohol).—Light brownish yellow. Fins pale. Abdomen greenish. Lips dark. Inside of mouth light. Gill cavities black. Peritoneum blackish or dusky. Type 10¼ inches long, with well developed ova.

Nine specimens, 7½ to 10¼ inches long, from station 3472; 295 fathoms.

Type.—No. 47724, U.S.N.M.

CONGERMURÆNA ÆQUOREA, new species.

(Plate XXXVII.)

Head 6½ to 6⅘ in total length; depth about 15 to 18. Head and trunk much shorter than tail, about 1⅗ in the latter. Pectoral rays 14 to 15.

Body slender, compressed. Head as deep as wide, tapering forward to a flat snout. Snout 3 to 3¼ in head, slightly more than twice as long as the eye, projecting two-thirds the diameter of the eye beyond the tip of the lower jaw. Eyes somewhat elliptical, their upper margins near dorsal profile. Interorbital space about equal to long diameter of eye. Anterior nostril a broad, short tube situated on the antero-lateral part of the snout, and a little nearer the mouth than the dorsal profile; posterior nostril a large, elliptical opening in front of the upper third of the eye, less than its own diameter from the eye. Pores of snout arranged as follows: A small pair under tip of snout just in front of anterior teeth; a large one in front of, a second above, and a third immediately behind, anterior nostril; four others along the side of the upper jaw; one behind angle of mouth. A row of about 10 pores on each mandible, beginning at tip of lower jaw and extending beyond its posterior angle. Angle of mouth reaching middle of orbit. Lips thin. Maxillary teeth close set in a broad villiform band, the outer teeth longer than the inner. Vomerine teeth much larger, forming a broad transverse patch in advance of maxillary teeth. A very few small teeth on shaft of vomer. Mandibular teeth in a narrow cardiform band anteriorly, diminishing much in size toward angle of mouth. Tongue free. Gill openings far apart, their width a little greater than diameter of eye, the distance between them about 5 in head. Gills 4; no rakers. Lateral line above middle of body anteriorly. The dorsal fin begins slightly behind the base of the pectoral, its distance from occiput equaling distance of latter from center of eye. Pectorals small, pointed, equal to the snout.

Color (*in alcohol*).—Brown; head and back dusky. A large, dark, opercular spot; another small one above each eye, and a dark streak on snout in front of eye. Sides of tail with coarse black specks, much more numerous in one of the specimens than in the other, mainly collected into two lengthwise lines running parallel with the bases of the dorsal and anal; the other specimen is almost plain. Marginal portions of dorsal and anal fins dusky, becoming black posteriorly, basal portions light. Inside of mouth a little dusky. Peritoneum silvery, speckled, or brownish. Alimentary canal black.

Two specimens, 16¼ and 18½ inches long, from station 3474; 375 fathoms.

Type.—No. 47696, U.S.N.M.

Family AULOPIDÆ.

CHLOROPHTHALMUS PRORIDENS, new species.

(Plate XXXVI, fig. 2.)

Head 3⅔; depth 5⅝. I D. 10 to 12; A. 10; P. 14 to 15; V. 9; lateral line 50.

Body as broad as deep in front of first dorsal; compressed below and behind this fin. The least depth of tail 2⅔ in greatest depth of trunk.

Head depressed throughout, broad behind and narrowing by slightly rounded lateral outlines to a broad flat, much depressed, somewhat scoop-shaped snout. Width of head behind orbit $1\frac{4}{5}$ to 2 in its length; width of snout at end of its anterior fourth $3\frac{2}{3}$ in head. Bones of the head very thin and cavernous. Orbits enormously large, a little longer than deep, $2\frac{2}{3}$ in head. Interorbital space very narrow, about $6\frac{1}{2}$ in orbit, with a median groove bordered on each side by two small ridges. Snout $3\frac{3}{4}$ in head. Lower outline of the head markedly rounded; mouth oblique, the maxillary abruptly expanded behind, rounded at the end, and reaching to about the front of the pupil or a little beyond. Premaxillary very slender, nearly as long as the maxillary. Lower jaw entirely included laterally, much less oblique than the upper jaw, its tip forming a broad dentigerous lobe which enters the profile and extends well beyond the premaxillaries. Symphyseal teeth form a rounded patch on each side of the middle line, those of the anterior series largest, strong, conical, directed horizontally forward. Jaws with very narrow bands of small teeth; vomer with a few teeth on its prominent anterior descending processes; a short, very narrow band on palatines. Tongue broad, flat, and thin. Nostrils far apart, close to anterior rim of orbits. Posterior edge of preopercle directed downward and a little forward, its angle broadly rounded under posterior rim of orbit. Opercle broad, with a prominent triangular lobe reaching beyond the upper part of base of pectoral fin. Gill membranes not united. Pseudobranchiæ large. Gill rakers slender, their length a little more than interorbital space, about 21 on horizontal limb of anterior arch. Scales large, thin, cycloid, somewhat deciduous; 6 in a transverse series between the lateral line and the origin of the dorsal fin. Interorbital space, snout, jaws, and (probably) opercles scaleless. Cheeks with excessively thin and weak scales. Distance from tip of snout to origin of first dorsal $2\frac{3}{4}$ in length of body; distance between dorsals $3\frac{3}{7}$, from tip of snout to base of ventrals $2\frac{2}{5}$, from base of ventrals to origin of anal $2\frac{1}{5}$, and from vent to origin of anal $3\frac{1}{2}$, in length of body. Base of the dorsal fin about $2\frac{2}{3}$ in head. Adipose dorsal small, above the middle of the anal. The anal far back, its base about 4 in head. Pectorals narrow, their base about 3 in orbit, their longest rays reaching to or beyond vent, about $1\frac{1}{2}$ in head. Ventral rays, especially the outer ones, strong, the longest (all injured) about $1\frac{1}{2}$ in head.

Color (in alcohol).—Parts where the scales have fallen off dusky brown. Scales quite silvery. The breast and sides above the ventral fins densely speckled with brownish black, other parts sparsely speckled. Snout, jaws, and interorbital space dusky. Cheeks silvery. Anterior part of first dorsal, three inner rays of ventrals, and upper part of axils, the gill cavities and posterior part of mouth cavity, black. Peritoneum black.

Type 7 inches, with well-developed ova.

Young, $3\frac{1}{2}$ inches long. Head $3\frac{3}{5}$; depth about 7; orbit, $2\frac{1}{3}$ in head; depth of tail, $2\frac{1}{3}$ in depth of trunk. Distance between dorsals 3, from

tip of snout to base of ventrals $2\frac{1}{2}$, from vent to origin of anal 4, in length of body. Faint traces of dark cross bands on body and tail.

Six specimens, $3\frac{1}{4}$ to 7 inches long, from stations 3475 and 3476; 351 and 298 fathoms, respectively.

Type.—No. 47715, U.S.N.M.

Family MYCTOPHIDÆ.

DIAPHUS UROLAMPUS, new species.

(Plate XXXVIII, fig. 1.)

Head $3\frac{2}{3}$; depth $4\frac{2}{5}$. D. 14 to 15; A. 14 or 15; P 15; V 8; lateral line about 29 to 35.

Body elongate, compressed, its width 2 in its depth; least depth of peduncle $2\frac{2}{3}$ in greatest depth of trunk. Dorsal and ventral outlines nearly similar, the former highest at origin of first dorsal fin. The depth at the nape very nearly equal to the depth at origin of first dorsal; depth at origin of anal $1\frac{1}{4}$ in this distance. Head stout, compressed, its dorsal outline parabolic, its greatest width over preopercle $1\frac{1}{2}$, and its width at anterior rim of orbit $2\frac{2}{3}$ in its greatest depth. Orbit moderate, circular, $3\frac{2}{5}$ in head. Interorbital space a little convex, broad, equal to orbit. Snout steep, blunt, short, 2 in orbit, its tip nearly on a level with the center of the eye. A slight median ridge running up on to the interorbital space. Mouth very large, somewhat oblique, curved upward a little in front of orbit; maxillary slender, but little expanded posteriorly, $1\frac{2}{3}$ in head, reaching about two-fifths of its own length beyond posterior rim of orbit. Teeth in narrow bands on jaws, vomer, and palatines. The sharp edges of the rami of the lower jaw nearly meeting in median ventral line. Nostrils about on a level with center of eye, the anterior opening about midway between tip of snout and anterior margin of orbit, much smaller than posterior opening. Posterior margin of preopercle very oblique. Opercle thin with a triangular lobe reaching about to base of pectoral; a little incurved above and below the lobe, scarcely covering the gills. Fourteen rakers on horizontal limb of anterior arch, the longest a little less than 2 in orbit. Bones of head thin, flexible; a ridge behind eye terminates in a rather strong spine at upper angle of preopercle.

Scales thin, cycloid, deciduous; 4 in a transverse series between lateral line and origin of first dorsal.

Photophores.—Mandibulars 4 pairs, very indistinct; operculars 2, the upper on level of base of pectoral fin, the lower minute, just behind angle of jaws; pectorals 3, the first immediately below lateral line, the second immediately in front of and below base of pectoral fin, the third nearly midway between this and the foremost thoracic spot; the second of these spots forms an obtuse angle with reference to the other two; thoracic 5, the first and second pairs far apart, the second pair nearly midway between first and fifth pairs, the fourth far up on the sides

above the interspace between the third and fifth pairs, the fifth in front of base of ventral fins; supraventral 1, immediately under lateral line; ventrals 5, the second and third high up on the sides and nearly on a level with the base of the pectoral fin; supraanals 3, forming nearly a right-angled triangle, with one of the spots above the hindmost ventral spot, the second immediately below the lateral line, and the third nearly above the first anterior anal spot; anterior anals 6, equidistant, the hindmost above and behind the fifth and on a line connecting the fifth anterior anal and the postero-lateral; postero-lateral 1, immediately under lateral line and above interspace between last anterior anal and first posterior anal; posterior anals 6, equidistant; caudals 4, in an obliquely directed shallow curve concave forward. The spots are divided into halves by a line of black pigment. A long gland extending the length of 6 or 7 scales, on the back of the caudal peduncle, present in five adults, faintly developed in one young specimen and entirely absent in one adult. No glandular photophore on snout.

The distance from tip of snout to origin of first dorsal or to base of ventrals $2\frac{1}{3}$ in length of body; from origin of first dorsal to second dorsal $2\frac{2}{3}$; length of base of first dorsal about $5\frac{2}{3}$; length of base of anal $5\frac{5}{6}$; from base of pectorals to base of ventrals 7; from base of ventrals to origin of anal $4\frac{1}{2}$ to $4\frac{1}{3}$ in length of body.

Pectoral fins inserted low, only a little above the line from outer part of base of ventrals to angle of mouth, the fins narrow, weak, about $2\frac{1}{4}$ in head. Ventral rays strong, reaching to or beyond origin of anal. Longest anal rays considerably less than 2 in head. Caudal deeply forked, the longest rays at least two-thirds as long as head.

Color (in alcohol).—Snout and anterior part of interorbital space whitish or yellowish; an area over each orbit and the upper part of eyeball black. Cheeks silvery; opercle silvery and black, breast and abdomen dusky silvery; body blackish; scales with some metallic luster. Gill and mouth cavities black. Fins all black at base, then whitish. Peritoneum black.

Seven specimens, $2\frac{1}{4}$ to $4\frac{1}{4}$ inches long, from stations 3467 and 3472; 310 and 295 fathoms respectively.

Type.—No. 47709, U.S.N.M.

This species differs from other known species of the genus in the absence of phosphorescent blotches on anterior part of head. This character seems to us to be of specific importance only.

DIAPHUS CHRYSORHYNCHUS, new species.

(Plate XXXVIII, fig. 2.)

Head $3\frac{2}{7}$ to $3\frac{2}{5}$; depth $4\frac{2}{5}$ to $4\frac{2}{3}$; D. 17; A. 16; P. 11; V. 8; lateral line, 34 to 35.

Body elongate, compressed, its width $1\frac{2}{3}$ in its depth. Dorsal and ventral outlines similar, the depth at nape and at origin of first dorsal

equal; least depth of peduncle $2\frac{1}{3}$ in greatest depth of trunk. Head heavy, compressed, it greatest width $1\frac{2}{5}$, and its width in front of orbit 3 in its greatest depth. Snout very blunt and short, its anterior profile nearly vertical. Orbit moderate, far forward, nearly circular, 3 to $3\frac{1}{4}$ in head. Interorbital space broad, convex, its width equal to orbit. A slight median ridge running up onto the interorbital space. Mouth large, oblique, the maxillary slender, $1\frac{2}{3}$ in head, its posterior end extending about one third of its total length beyond the posterior rim of orbit. Teeth small, in narrow bands on jaws and palatines; a single series on each jaw larger than the rest. A large patch of small teeth or asperities on pterygoid. Posterior edge of preopercle directed upward and forward. Opercle with a long, triangular pointed lobe, about on a level with lower edge of orbit and extending beyond the root of the pectoral, the edges above and below the lobe slightly emarginate, barely covering the gills. Gill rakers slender, 2 in orbit, 15 on horizontal limb of first arch. Bones of head thin and flexible. No distinct orbital or postorbital spine.

Scales thin, cycloid, not serrated, moderate, those of lateral line not enlarged; 3 in a transverse series between lateral line and origin of dorsal. Cheeks, opercles, and interorbital space scaly.

Photophores.—Mandibulars 3 pairs, operculars 2, the upper apparently double, the lower minute, behind angle of jaw; pectorals 3, the uppermost above opercular lobe at lower edge of second or third scale of lateral line, the second in front of middle of base of fin, and the third midway between this and the foremost thoracic spot, the three forming an obtuse angle at base of pectoral fin. Thoracic 5, the first and second pairs far apart, the fourth pair almost directly outside of the third. Supraventral 1, about midway between lateral line and and base of ventral fin; ventrals 5, the first pair close together between bases of ventral fins; the first three equidistant and forming a straight line diverging backward from midventral line; supraanals 4, one immediately under lateral line and forming with two others a straight line extending obliquely downward and forward, the fourth a little above and in front of the first anterior anal spot; anterior anals 5, equidistant, the last three forming a gentle curve upward toward the postero-lateral; postero-lateral 1, under lateral line and a very little behind the hindermost anterior anal; posterior anals 5, equidistant; caudals 4, equidistant, in a gentle curve with the concavity forward. The spots are divided by a black septum. Anteorbital gland, orange-colored; a triangular or heart-shaped portion of it at the antero-dorsal angle of orbit; within and below this the organ occupies the entire area between orbit and middle line down to nostrils and between orbit and maxillary backward to about the vertical from the center of the eye.

Distance from tip of snout to origin of first dorsal and to base of ventrals $2\frac{2}{5}$ in length of body, from tip of snout to origin of anal $1\frac{3}{5}$, base of dorsal $4\frac{1}{2}$ to 5, base of anal 6, from root of pectorals to root of ventrals $6\frac{1}{4}$ in length of body. Pectorals inserted low, below the line

through lower rim of orbit and a little above the line from angle of mouth to root of ventrals; the fin narrow, weak, its length $2\frac{1}{4}$ in head. Ventrals broad, stronger. Caudal deeply forked.

Color (*in alcohol*).—Body blackish brown (where the scales have disappeared). A spot at base of each ventral fin, and a pair of spots on interorbital space over the eye and the anterior rim of orbit, jet black. Top of head and opercles, gill and mouth cavities, blackish. Scales silvery, iridescent. Peritoneum black.

Twelve specimens, 3 to $3\frac{3}{4}$ inches long, from station 286 (surface tow net, lat. N. 21° 15′ 49″, long. W. 157° 44′ 27″); and from Iiao Makanni.

Type.—No. 47710, U.S.N.M.

This species differs from *Diaphus theta* and *D. engraulis* in the extreme development of the preocular photophore.

MYCTOPHUM FIBULATUM, new species.

(Plate XXXVIII, fig. 3.)

Head $3\frac{1}{10}$; depth $4\frac{1}{4}$. D. 12; A. 19; P. 16; V. 8; pores of lateral line about 27 or 28.

Body compressed, its width about 2 in its depth. Least depth of peduncle $2\frac{2}{3}$ in greatest depth of body. Dorsal and ventrals outlines nearly similar, the depth of body a little greater at origin of first dorsal than at the nape. The peduncle somewhat expanded at base of caudal fin. Head stout, compressed, its dorsal outline parabolic, its greatest width about $1\frac{2}{5}$ in its greatest depth, its width at anterior rim of orbit $2\frac{1}{2}$ in the greatest depth. Orbit large, circular, $2\frac{3}{4}$ in head, its upper rim nearly entering profile. Interorbital space nearly flat, broad, $1\frac{1}{2}$ in orbit. Snout steep, blunt, short, 2 in orbit, its tip a little above the level of the lower edge of the pupil. Mouth somewhat oblique, maxillary $1\frac{2}{3}$ in head, reaching about one-fourth or one fifth of its own length beyond the posterior rim of the orbit. Teeth very small, in narrow bands on the jaws and palatines. Lower jaw with a very small symphyseal knob, the sharp edges of the rami meeting in a slight ridge in the median ventral line. Nostrils nearly midway between tip of snout and anterior rim of orbit, about on a level with the center of the eye, the two openings very close together and nearly equal in size. Orbital margin separated by a groove and a ridge from the preopercle. Posterior preopercular margin somewhat rounded (injured), extending obliquely upward and forward. Opercle with a broad, rounded upper angle and a small pointed triangular projection just above the base of the pectoral fin, which it reaches. Bones of skull thin and flexible. About 18 gill rakers on anterior limb of first arch, slender, long, 2 in orbit. Scales large, thin, cycloid, deciduous (nearly all gone from the single specimen except those of the lateral line and those with phosphorescent spots). Interorbital space, snout, and lower jaws naked. Cheeks and preopercle with very thin scales.

Photophores.—Mandibular, 3 pairs in a curved line; operculars 2, the upper elongated vertically and on a level with lower rim of orbit; pectorals 3, forming an acute triangle, the uppermost high up, on a level with the lateral line, another at lower base of pectoral, and the third in front of and a little below the second; thoracic 5, the anterior pair very close to middle line, the first 4 pairs nearly equidistant, the spots of the fifth pair far apart, separated by entire width of base of ventrals; supraventral 1, high up, its distance below lateral line about 3 in orbit; ventrals 3, nearly equidistant; supraanals 4, in an elegant curve, concave upward, the foremost a little above and behind the base of ventral fin, the hindmost immediately under lateral line, a very little behind first anterior anal spot; anterior anals 6, equidistant except the first and second, which are a little farther apart; posterior anals 4, equidistant, the distance between first posterior anal and last anterior anal equal to distance between first and second anterior anals; posterior lateral 1, immediately under lateral line and over last anterior anal; caudals 2, the distance between them equal to distance between anterior caudal spot and the hindermost spot of posterior anal series. Photophores not divided into halves by dark bands. A small glandular patch on back of peduncle immediately in front of rudimentary caudal rays. Postorbital part of head 2 in its whole length. Origin of first dorsal midway between tip of snout and anterior rudimentary caudal rays. Distance between dorsals very little greater than distance between origin of anal and base of ventrals; from tip of snout to base of ventrals a little less than from tip of snout to origin of dorsal. Base of dorsal about $2\frac{1}{4}$, base of anal $1\frac{2}{5}$ in head. Rays of all the fins more or less injured; pectorals narrow, slender, very long, reaching about to origin of anal.

Color (in alcohol).—Scaleless parts of skin dusky to blackish brown. Scales silvery, steel blue, iridescent; cheeks and opercles silvery, iridescent. Snout whitish. Base of caudal and anal and upper rays of pectoral blackish; ventrals, lower short rays of pectoral, and distal part of anal white; caudal, first dorsal, mouth cavity, and anterior part of gill cavity dusky. Adipose dorsal white, black at base. Peritoneum black.

One specimen, 4 inches long, from station 3467; 310 fathoms.

Type.—No. 47711, U.S.N.M.

DASYSCOPELUS PRISTILEPIS, new species.

(Plate XXXIX, fig. 1.)

Head $3\frac{2}{5}$; depth $4\frac{1}{4}$. D. 12 to 13; anal 18; pectoral about 17; ventrals 8; lateral line (pores) 35 to 38.

Body elongate, compressed, heavy in front, its greatest width (over the pectorals) $1\frac{1}{2}$ in the depth. Depth at nape and at origin of first dorsal equal; thence to the caudal the dorsal outline descends gently and regularly, while the ventral outline ascends more rapidly

under the base of the anal than elsewhere. Least depth of peduncle about 3 in depth of trunk. Head heavy, compressed, its greatest width about $1\frac{1}{2}$, its width at anterior rim of orbit 3, in its greatest depth. Orbit large, circular, $2\frac{1}{3}$ in head, far forward, its dorsal rim nearly entering the profile. Interorbital space broad, nearly flat, narrower forward, its width above center of eye about 3 in head. Snout steep, very short, bluntly rounded, its tip nearly on a level with the lower edge of pupil. Nostrils on a level with center of eye, the posterior much larger, close to the anterior rim of orbit. Mouth oblique, the gape slightly curved, maxillary $1\frac{3}{5}$ in head, reaching to vertical from posterior rim of orbit. Narrow bands of villiform teeth on jaws; minute asperities on vomer and palatines. Posterior edge of preopercle nearly vertical. Opercle thin, its posterior margin rounded with only a slight, blunt point. Gill rakers slender, about $2\frac{1}{3}$ in orbit, about 17 on horizontal limb of first arch. Scales large, firm; their edges strongly toothed, the teeth entirely absent or obsolescent on scales of lateral line. Scales of lateral line and of the trunk below it with the vertical diameter much greater than the horizontal. Large scales on checks and opercles, 2 in a transverse series between lateral line and origin of first dorsal.

Photophores.—Mandibulars 3 pairs, operculars 2, the lower one small, opposite angle of jaws; pectorals 3, forming an isosceles triangle with the apex directed backward, the upper spot a little above and in front of base of pectoral, the middle one immediately under base of pectoral, and the third nearly midway between this one and the first thoraic spot; thoracic 5, nearly equidistant, the hindermost in front of external end of base of ventral fin; supravental 1, midway between ventral fin and lateral line; ventrals 4, equidistant; supraanals 3, in a gently curved line, with the concavity forward, nearly equidistant, the lowermost above the hindermost ventral spot, the uppermost immediately under lateral line; anterior anals 8, equidistant, in a nearly straight line; postero-lateral 1, under lateral line and above last supraanal spot; posterior anals 4, equidistant; caudals 2, close together near ventral profile. Each of the spots surrounded by a broad, black rim, but not divided into two halves by a black septum. Distance from tip of snout to origin of dorsal $2\frac{2}{5}$; to root of ventrals $2\frac{2}{7}$; from root of ventrals to origin of anal 6; base of anal 4; base of dorsal 6 to 7 in length of body. Pectoral fin a little below the level of center of eye, narrow, slender, the longest rays about 5 in length of body. Ventral rays strong (broken off). Anterior anal rays much stronger and longer than the posterior; dorsal rays in a groove formed by elongate scales. Caudal deeply forked.

Color (in alcohol).—Back and top of head blackish; sides, opercle, and cheek, and under side of lower jaw silvery; all the scales with metallic luster; snout yellowish white. Gill and mouth cavities blackish, first dorsal and caudal fins dusky, the others pale. Peritoneum blackish brown.

Two specimens, 2½ inches long, from station 286 (surface tow net, lat. N. 21° 15′ 49″, long. W. 157° 44′ 27″).

Type.—No. 47737, U.S.N.M.

NEOSCOPELUS MACROLEPIDOTUS, Johnson.

Nine specimens, 4 to 8½ inches long, from stations 3470 and 3474; 343 and 375 fathoms respectively.

Taken heretofore at Madeira (Johnson) and Kermadec Islands (*Challenger*).

Family MAUROLICIDÆ.

ARGYRIPNUS, new genus.

Body much compressed, oblong or elongate, passing gradually into the slender tail, covered with very thin, flexible, cycloid, deciduous scales. Head longer than deep, without spines, its bones thin and flexible. Maxillary sickle-shaped, with spatulate supplemental bone. Eye large. Dorsal fin on middle of back, without anterior spinous dilatation. A large (double) luminous organ on preopercle and series of equidistant organs on branchiostegals, isthmus, breast, abdomen, and lower part of side. A continuous series from above base of ventral fin to about the end of the anterior third of the base of the anal fin. A closely set series of five spots above middle of anal fin, and another series of fifteen beginning above hinder end of anal and extending to the anterior rudimentary rays of the caudal.

ARGYRIPNUS EPHIPPIATUS, new species.

(Plate XXXIX, fig. 2.)

Head a little more than 3; depth 3⅓. D. 10; A. 22; P. 15.

Body strongly compressed, its width 2⅔ in the greatest depth. Dorsal and ventral outlines nearly similar, but the former descends more rapidly under the dorsal fin than elsewhere and the latter ascends a short distance very abruptly behind the base of ventral fins. Depth of body at the nape and at origin of dorsal fin equal; least depth of peduncle 3 in greatest depth of body. Head compressed, its greatest width (behind the orbit) 2 in its greatest depth; its dorsal and ventral profiles similar, stongly curved. Orbit large, 2½ in head, circular, its upper margin entering profile. Interorbital space (somewhat crushed in the single specimen) about 5½ in head. Snout broad, short, about 2 in orbit, its tip on a level with center of eye. Mouth wide, very oblique anteriorly. Premaxillary slender, nearly as long as orbit, forming an angle of about 45° with axis of body, its lower end reaching about to the vertical from anterior margin of orbit. Maxillary reaching very nearly to posterior margin of orbit, somewhat sickle-shaped, with a rather sharp curve opposite the lower end of the premaxillary, and slightly overlapped at its posterior end by its spatulate supplemental

bone. Lower jaw entirely included laterally, and concealed by the overhanging maxillary, curved upward anteriorly, its tip entering profile. Teeth on premaxillary, maxillary, mandible, and palatines, few, in single series, sharp and slender; a tooth on each premaxillary about midway of its length, the anterior tooth of the palatine series and one or more at the side of the lower jaw longer than the rest. Tongue broad, free in front. Preopercular edge nearly vertical. Gill membranes not united. Pseudobranchiæ large. Gill rakers long, $2\frac{1}{2}$ in orbit, 15 on anterior limb of first arch. Bones very thin and flexible, the usual deep-sea characters prominently developed. Scales large, very thin and flexible, cycloid, highly deciduous, nearly all lost in the type specimen, which is here figured as it appears, scaleless with conspicuous muscular impressions.

Phosphorescent organs.—Two on opercle below the level of the orbit, one above the other, at the two ends of a short vertical steel-blue band from which they are separated by small black cross bands; one on cheek immediately behind tip of maxillary; 5 oblong (vertical) spots on branchiostegal membranes; a curved row of 6 nearly circular spots from base of pectoral to anterior end of isthmus; a nearly straight row of 10, equidistant, circular and smaller, on each side of middle line, beginning at humeral symphysis and running along abdomen to front of base of ventrals; a series of 7 oblong, vertical organs, yellowish at the lower and pearl-colored at the upper end, farther up on the side, on a level with the pectoral fin; immediately behind this, over the root of the ventral fin, begins a series of 19 organs which gradually become smaller posteriorly, and runs gently dorsalward to origin of anal, then rises a little higher with an abrupt curve and continues horizontally to about the end of the anterior third of base of anal; behind this a series of 5 small organs above the middle of anal; a series of 15 very small organs begins just in front of the end of the anal and extends along its base and close to the mid-ventral line of the caudal peduncle to the root of the anterior caudal rudiments; probably one in front of and one behind the orbit (injured.)

Distance from tip of snout to origin of dorsal $2\frac{1}{4}$ in length of body, from tip of snout to root of ventrals $2\frac{1}{7}$, to origin of anal $1\frac{3}{4}$, length of base of dorsal 7, base of anal $3\frac{1}{5}$ in length of body. Vent midway between root of ventrals and origin of anal. Pectoral fin very low, the lower end of its base nearly entering ventral profile, narrow, its longest rays reaching the vent, 4 in length of body. Rays of all other fins badly injured; anterior rays of anal much stronger than the posterior. Origin of anal a little in front of end of first dorsal.

Color (in alcohol).—Snout and most of jaws yellowish white; posterior part of interorbital space, occiput, and back nearly to dorsal fin, upper three-fourths of eyeball, sides of head behind orbit, isthmus, breast, abdomen, areas occupied by the phosphorescent organs, gill and mouth cavities, black. Small black dots at the base of the rays of the

dorsal and the anterior rays of the anal; pectorals dusky, other fins pale; a black area on posterior part of peduncle and two black spots at the base of the dorsal and ventral caudal rays. Peritoneum black.

One specimen, 3½ inches long, considerably injured about head and fins. Station 3472; 295 fathoms.

Type.—No. 47708, U.S.N.M.

Family STERNOPTYCHIDÆ.

POLYIPNUS SPINOSUS, Günther.

One specimen, 2 inches long. Station 3476; 298 fathoms.

STERNOPTYX DIAPHANA (Hermann).

Two specimens, 1⅝ inches long, from station 3473; 313 fathoms.

Locality.—Atlantic and Pacific. Günther describes two forms of this species. These two specimens belong to the form with larger eye, and the upper part of the mouth conspicuously above the level of the lower margin of the orbit.

MELANOSTOMA ARGYREUM, new species.

(Plate XXXIX, fig. 3.)

Head 2⅞; depth 3⅞. D. IX–I, 9; A. II, 7; P. 14, 15; V. I, 5; lateral line 28 to 29 (+2, 3 on tail).

Body elongate, compressed, its width at base of pectorals nearly 2 in the depth. Least depth of caudal peduncle 2¼ in greatest depth of body. Head compressed, its greatest width 1½ in the greatest depth. Dorsal and ventral profiles convex, similar. Orbit large, 3 to 3¼ in head. Interorbital space convex, its width a little less than orbit, divided into areas by a series of low, thin ridges; one of these, not quite as long as the snout, extends forward along the median line of the occiput to about the vertical from the posterior margin of the orbit; on each side of this, a little behind its anterior end, begins a curved ridge which runs forward and outward to about the vertical from the hinder edge of the pupil and thence forward and inward to the median line between the anterior nares, these symmetrical ridges forming a pear-shaped figure with its pointed end directed forward; on each side, at the greatest convexity of the above ridges, at the vertical of the posterior margin of the pupil, begins another ridge which runs straight forward and outward close to the antero-dorsal margin of the orbit, then curves inward and forward inside of the nares to a point in advance of the anterior nares and not far from the middle line.

Snout 1¼ in orbit, its tip about on a level with the lower margin of the pupil. Posterior nares narrow, vertical slits close in front of rim of orbit, on a level with upper rim of pupil; anterior nares small, circular; the distance between the posterior and anterior nares 5 in orbit.

Jaws equal, or the lower very slightly projecting, entering the steep profile. Maxillary with a ridge along the middle, reaching to or a little beyond center of eye, 2¼ in head, much expanded behind, the end emarginate, the lower posterior angle somewhat enlarged into a lobe. Small teeth in bands on jaws, vomer, and palatines; a large canine tooth inside of the band of small teeth near the anterior end of each premaxillary, the tip of the lower jaw fitting between them. Each ramus of the lower jaw with 9 canine teeth in a single series; 2 very close together, at each side of the tip of the lower jaw; just outside of these a depression in the jaw into which fits the canine of the upper jaw; behind this 7 nearly equidistant teeth, of which the most anterior is the smallest and the fourth largest or as large as those behind it. The small teeth outside of the row of canines, very few in number in the lower jaw. The canines sometimes as few as 5 in number on each side. Suborbital ring narrow. Posterior edge of preopercle nearly vertical and straight, directed a little downward and backward and very slightly curved backward near its posterior end, producing a prominent rounded angle. Both edges closely serrated, the serrations strongest, almost in the form of small spines, at the angle. The ridge of the preopercle forms a rounded and obtuse but marked angle, its inferior edge serrated. The opercle with two slightly diverging ridges, the lower nearly horizontal and a little more strongly developed than the upper, both ending in small spines. Gill rakers 13 on the anterior limb of first arch, the longest about 3 in eye. The lateral line is high up, and continued onto the basal part of the caudal fin. Scales large, thin, cycloid, very deciduous; 2 in a transverse series between the lateral line and the origin of first dorsal fin. Interorbital space, snout, and lower jaw, and apparently the maxillary and opercles scaleless. Cheeks with large, thin, embedded scales. Second dorsal, anal, and caudal scaly on their basal parts. The origin of the first dorsal fin is over the root of the pectoral, its third spine probably the longest, at least half as long as head, the spines slender and weak. Origin of second dorsal a little in front of origin of anal, the rays heavy. The first spine of the anal fin short, the second longer, 1½ in orbit, the soft rays thick. Caudal deeply forked, the longest rays at least half length of head. The ends of the rays of second dorsal, of anal, and caudal all injured. The upper end of root of pectoral about on a level with lower edge of pupil, the width of the base less than half orbit, the longest rays (injured at tips) at least two-ninths of body length. Root of ventrals under root of pectorals. Spine of ventral fin long, 2½ in head, its outer edge densely serrate, the soft rays more than half as long as head. Distance from tip of snout to origin of first dorsal $2\frac{2}{3}$ in length of body, from tip of snout to origin of anal a little more than 1½; from root of ventrals to origin of anal $3\frac{1}{8}$, base of first dorsal $5\frac{1}{2}$, base of second dorsal $8\frac{1}{3}$, distance between dorsals 10, base of anal 9, in the body length.

Color (in alcohol, scales nearly all off).—Back and upper part of sides light brownish, with black lines at the edges of the fallen scales. Top of head and snout dusky. Sides of head and lower three-fifths of trunk and tail silvery. First dorsal fin blackish in the distal half; the other fins a little dusky. Mouth cavity not dark; gill cavity a little dusky. Peritoneum black.

A second, smaller specimen differs from the type in having only 5 instead of 9 canines in each lower jaw, its depth is a little greater, orbit larger, gill rakers a little shorter. Aside from some very slight differences in the proportions, it agrees in even minutest details with the type.

In some respects close to *Melanostoma japonicum*, Steindachner and Döderlein, differing from it, among other characters, in its serrated ventral spine, larger number of canine teeth, greater length of second anal spine, in the color, the relative development of the two opercular ridges, and the absence of black color in the mouth cavity.

Two specimens, $3\frac{3}{4}$ and $5\frac{1}{2}$ inches long, from stations 3472 and 3476; 295 and 298 fathoms, respectively.

Type.—No. 47732, U.S.N.M.

Family SCORPÆNIDÆ.

SCORPÆNA REMIGERA, new species.

(Plate XL.)

Head $2\frac{1}{4}$ to $2\frac{1}{3}$; depth $2\frac{2}{3}$. D. XII, 10; A. III, 5; P. 21; V. I-5; lateral line 29 (pores), the number of scales much larger, not to be exactly counted.

Body ovate, deep, strongly compressed, its width $2\frac{1}{5}$ in its depth. Least depth of the peduncle $4\frac{1}{3}$ to 5 in greatest depth of body. Head compressed, its width $1\frac{1}{2}$ in its greatest depth; its profile steep, nearly straight. Bones of skull thin, cavernous. Orbit moderate, nearly circular, 4 in head. Interorbital space flat, with a pair of prominent oval mucous openings, and behind these a larger median triangular depression covered by a thin membrane. Snout about equal to orbit. Spines of head small and sharp. Preorbital with three divergent spines, the first directed forward, the second forward and downward, and the third downward and backward. Suborbital stay rather prominent, cavernous, with usually a minute spine near its posterior end. Small preocular, supraocular, occipital, and paroccipital spines present. Occipital ridges thin but evident. Preopercular spines divergent 5, the 3 upper long and sharp, second usually longest, the 2 lower small or obsolete. Opercle with two diverging ridges, the lower nearly horizontal, the upper directed upward toward the tip of the opercular lobe, both ending in sharp spines. Mouth large, but little oblique, the tip of the upper jaw about on a level with the lower rim of orbit; the maxillary 2 in head, reaching a little beyond pupil, its posterior end dilated, $1\frac{2}{3}$ in

orbit. Narrow bands of villiform teeth on premaxillary and mandible; a few teeth on vomer; a very few on anterior part of palatines. Lower jaw not projecting, its tip fitting into a small notch between premaxillaries. Small pseudobranchiæ present. Gill lamellæ small; rakers far apart, rather slender, the longest about $2\frac{1}{2}$ in orbit, 9 to 10 on the anterior limb of first arch. Scales very small, cycloid, somewhat deciduous, 10 to 11 in a transverse row between lateral line and origin of spinous dorsal. Cheeks and opercles scaly. Interorbital space, snout, and jaws naked. Pectoral fin broad, its base 3 in depth of body; some of the upper rays branched, the lower rays not procurrent or thickened, the middle rays longest, equal to depth of body, or $2\frac{2}{7}$ in its length, reaching to or nearly to the end of the base of the anal fin. Ventral fin under the pectoral, 4 in length of body, reaching nearly to vent, the spine long and strong, $1\frac{1}{2}$ in the soft rays, the interior ray attached for half its length by a membrane to the body wall; anal spines slender, graduated, the first 2 to $2\frac{1}{2}$ in the third, the third equal or nearly equal to the ventral spine and a little shorter than the soft anal rays. Dorsal spines slender, sharp, the fourth spine longest, twice as long as the first; the eleventh very small, one-third as long as the first; the twelfth long, apparently belonging to the second dorsal fin, $1\frac{3}{4}$ in the fourth spine; the soft rays about equal to the longest spine. Caudal fin slender, the median rays longest. Distance from tip of snout to origin of spinous dorsal $2\frac{1}{3}$ in body; from tip of snout to root of pectorals $2\frac{1}{5}$, and to origin of anal $1\frac{1}{3}$, from root of ventral to origin of anal 3, in length of body. Base of soft dorsal a little more than two in spinous dorsal; total length of soft and spinous dorsals two in length of body. Length of anal base $3\frac{2}{3}$ to 4 in head. Mucous system highly developed. No dermal flaps. Vent just in front of anal fin.

Color reddish. Skin everywhere densely dotted with minute black specks; edge of spinous dorsal and base of soft dorsal, basal third of anal fin, the ventral fins, a ventral median band from root of ventrals to origin of anal, a spot with indefinite outlines under spinous dorsal, another under soft dorsal and a fainter one at posterior end of peduncle, the gill cavities and the posterior part of the mouth cavity, and the alimentary canal blackish or blackish brown. The external blackish areas are aggregations of dark dots. Peritoneum mostly silvery.

Three specimens, $3\frac{1}{4}$ to $4\frac{1}{4}$ inches, from station 3476; 298 fathoms.

Type.—No. 47726, U.S.N.M.

Family TRIGLIDÆ.

PERISTEDION HIANS, new species.

(Plate XLI, figs. 1, 2.)

Head (from front of premaxillaries) $2\frac{3}{5}$; depth $6\frac{1}{4}$. D. VII–22; A. 22; P. 17 (2, 15); lateral line about 34 (pores).

Body covered with 8 series of spongy, bony plates armed with sharp,

thin, recurved spines. One pair of plates between occiput and origin of first dorsal, their spines smaller than the following ones; 30 plates in the dorsal series, their spines nearly obsolete on the caudal peduncle. The superior lateral series with 34 plates, of which the 4 or 5 anterior ones are smaller, with smaller spines, and forming a decurved line from upper angle of opercle. Beginning with the fifth, the plates larger, with the largest spines on the body. Those of the succeeding plates decreasing regularly backward. The pores of the lateral line open below and behind the spines of this series. A space behind pectorals naked; behind this, about at the beginning of the distal third of pectoral fin begins the inferior lateral series of 25 plates. Twenty-six plates in the ventral series, the foremost pair about twice as long as wide, their length about five-sevenths of depth of body. Two pairs of plates of this series in front of vent, the spines of this series mostly weak, obsolete behind.

Greatest width of head about 3 to 3½ in length of body (from tip of premaxillaries). Edge of suborbital ridge slightly denticulate without spines or prominent lobes laterally, terminating behind in a long, slender spine about as long as preorbital projection. Above this are smaller spines, varying in number from one to three. Opercle with one moderate ridge ending in a small spine and above this another nearly obsolete ridge without spine. Preorbital projection triangular, rounded at tip, about equal to interorbital space, 3¼ in distance from tip of projection to front of orbit. Orbit 4 in head. Interorbital space concave, about 5 in head, with two slight longitudinal ridges diverging backward to base of supraocular spine, thence downward and outward behind orbit continuous with the slight paroccipital ridge, which ends in a small spine. Supraocular spines short, mostly blunt, occipital spines larger, compressed, rather sharp. Width of mouth about 2½ in head; distance from tip of lower jaw to tip of premaxillaries nearly equal to interorbital space, posterior angle of lower jaw reaching beyond anterior third of orbit. The jaw armed on the outer side posteriorly with two flat, finely spinulous plates. Two similar plates behind angle of jaw. Teeth none. Seven small barbels at each side of jaw anteriorly and two on its inner side close together and farther back. The large barbel, reaching to or beyond vent, provided on its anterior margin with a fringe of smaller barbels. The longest gill rakers about 4 in orbit. Ventrals reaching vent. Pectorals reaching beyond origin of anal, the upper free ray nearly as long as longest pectoral ray.

Color (in alcohol).—Head somewhat dusky; first dorsal, pectorals, and ventrals blackish, paler at base; axils dusky; second dorsal with a narrow black edge anteriorly. Peritoneum black. Length 7 inches. In a young specimen the dark coloring more marked, the distal half of the long barbel blackish, the spines sharper; edge of suborbital ridge with two small but marked triangular projections on the lines of

posterior suture of preorbital and the anterior suture of preopercle. The upper spine of preopercle minute. Head relatively longer; depth 5½.

Twelve specimens, 4 to 7½ inches, from stations 3470, 3472, and 3476; 343, 295, and 298 fathoms, respectively.

Type.—No. 47730, U.S.N.M.

Family MACROURIDÆ.

CŒLORHYNCHUS PARALLELUS, Günther.

One specimen, 4¾ inches long, from station 3473; 313 fathoms. Taken by the *Challenger* off New Zealand, Kermadec Islands, and Japan.

CŒLORHYNCHUS GLADIUS, new species.

(Plate XLI, fig. 3.)

Head 3⅔; depth 9½; B. 6. First dorsal I, 10 to I, 11; second dorsal quite well developed anteriorly, its longest rays nearly equal to interorbital space; anal rays delicate, slender; pectorals 18; ventrals 7.

Top of head evenly rounded, both transversely and longitudinally. Snout depressed, turned upward (its dorsal profile concave), very long, narrowed anteriorly, its tip produced as a long, strong, horny spine; length of snout, including spine, more than half head, the spine about one-third of the entire snout. The strong infraorbital ridge begins at the base of the rostral spine and extends in a nearly straight line downward, outward, and backward far beyond orbit, to the angle of the preopercle. Interorbital space very nearly equal to long diameter of orbit. A pair of minute parallel spiny ridges on occiput, another extending backward as a continuation of the upper orbital rim to above upper angle of gill opening. Orbit large, oblong, its vertical diameter much less than the longitudinal, the latter 1¼ in the postorbital part of head, about 4¾ in the whole head. Mouth small, entirely inferior, the maxillary reaching to about the middle of the orbit or a little beyond. Distance from tip of snout to front of premaxillaries very slightly less than length of snout and a trifle less than one-half length of head. Width of mouth equal to longitudinal diameter of orbit. Teeth in narrow bands on both jaws, none of them enlarged. Angle of preopercle a little produced, the posterior edge of preopercle nearly straight, directed upward and forward. Barbel minute, slender, about 3½ or 4 in the orbit. Gill membranes united, joined to the isthmus without free fold behind. Anterior gill slit only a small pore-like opening. Body compressed throughout, its greatest width 1¼ in its depth; trunk and tail tapering uniformly. Scales of moderate size, 6 or 7 scales in a transverse series between the lateral line and origin of first dorsal; scales from the back near first dorsal fin with about 20 to 25 small spinelets in usually 7 nearly parallel series, one from back in front of first dorsal with 11 spinelets in 5 series; another from ventral surface near origin of anal fin with 19 spinelets in 6 series; another from breast

with 10, rather irregularly arranged. All of the dorsal and lateral surfaces of head densely scaled; ventral surface of head and snout naked. A narrowly elliptical pit on median line in front of base of ventrals, naked in the young, covered with cycloid scales in adults. Second dorsal spine slender, not much prolonged beyond the rest, apparently smooth, but with 2 excessively minute spinelets, and 2 still more minute knobs, all placed considerable distances apart. Base of first dorsal nearly equal to interorbital space; distance between dorsals only one-third interorbital space. Pectorals narrow, 2 in head exclusive of rostral spine. Outer ventral ray somewhat elongated into a filament, nearly as long as pectorals, not reaching origin of anal. Distance from vent to isthmus about $1\frac{1}{4}$ in head exclusive of rostral spine; from base of ventrals to origin of anal, 2 in head; vent immediately in front of anal fin.

Color (in alcohol).—Light brownish, head a little dusky. A large round, black spot immediately above and behind base of pectoral fin. A broad, faint, cross band above origin of anal fin, and four other fainter ones on the tail. A small, round, brown spot on middle of occiput. Ventral part of trunk brownish black. Branchiostegal membranes with minute dark specks. First dorsal fin white, its anterior rays broadly black-margined. Ventrals white.

In a young specimen, $2\frac{3}{4}$ inches long, the rostral spine is only a small but well-marked flexible point; hence the head relatively shorter, $3\frac{1}{2}$ in total; scales very deciduous, their spinelets fewer, relatively longer and more slender; first dorsal spine with 3 or 4 very minute knobs or rudiments of spinelets. The spinelets on the characteristic ridges of the head sharp. Outer ventral ray much prolonged, reaching far beyond origin of anal; the color bands more marked. Distance from vent to base of ventrals less than one-half length of head (abdomen shorter than in adult).

Four specimens, $2\frac{1}{2}$ to $6\frac{3}{4}$ inches long, from station 3472; 295 fathoms.
Type.—No. 47706, U.S.N.M.

CŒLOCEPHALUS, new genus.

CŒLOCEPHALUS ACIPENSERINUS, new species.

(Plate XLII, fig. 1.)

Head about $4\frac{2}{5}$; depth $6\frac{3}{4}$ to 9; B. 7. First dorsal 1, 10 to 1, 11; second dorsal low; anal rays well developed; pectorals, about 22 to 24; ventrals, 8 to 9. Snout much depressed, flat, thin, projecting horizontally much beyond the mouth, its tip formed by a bifid, spinigerous tubercle, its length $2\frac{3}{5}$ in head, its lateral edges fringed with a thick, spinigerous roll of integument, extending backward to and contiguous with the prominent infraorbital ridge, which extends to below the posterior rim of the orbit and divides the cheek into an upper somewhat sloping and a lower nearly horizontal part. A small, bony prominence

nearly midway of this lateral ridge, in front of nostrils. Interorbital space flat between the two slightly raised orbital rims, about equal to vertical diameter of orbit. Orbit large, the longitudinal much greater than the vertical diameter, the former $3\frac{1}{3}$ to $3\frac{3}{4}$ in head.

Mouth small, wholly inferior, the distance from tip of snout to premaxillaries contained $2\frac{3}{4}$ times in length of head; the middle of cleft of mouth slightly behind middle of head, the maxillary reaching about to the middle of eye; its length one-third of snout and eye. The teeth in villiform bands in both jaws, none of them enlarged. Angle of preopercle a little prolonged into a lobe, the posterior margin directed upward and forward. Barbel minute, about 5 in orbit. Gill membranes broadly united, with a moderate free fold behind.

Body compressed, its width only about one-half its depth. Base of first dorsal oblique, its origin well elevated above general profile. Scales with 15 to 20 spinelets in about 4 to 6 parallel series. Scale from interorbital base with about 40 spinelets in about 9 radiating series. About 7 scales in a transverse series between lateral line and origin of first dorsal. Interorbital space, upper side of snout, and infraorbital ring scaly; entire lower side of head, including under side of snout and suborbital region, naked. Second dorsal spine a little curved, sharply serrate, prolonged into a filament, $1\frac{3}{4}$ in head. Base of first dorsal less than interorbital space; distance between dorsals less than twice the base of the first dorsal. Pectorals near axis of body, slender, 2 to $2\frac{1}{3}$ in head. Inner ventral rays reaching about to origin of anal, the outer ray prolonged into a filament nearly twice as long as the inner rays. No naked pit between bases of ventrals. Distance from vent to isthmus, $2\frac{1}{2}$ in length of head. Distance from vent to origin of anal but half its distance from base of ventrals.

Color (*in alcohol*).—Light brownish; snout and anterior part of head translucent whitish. Inside of mouth, gill cavities, and abdomen blackish. Fins dusky. Peritoneum brownish black dorsally, silvery ventrally.

Twenty-one specimens, $4\frac{1}{2}$ to $7\frac{1}{4}$ inches long, from stations 3470, 3471, 3473, 3474, 3475, and 3476; 343, 337, 313, 375, 351, and 298 fathoms, respectively.

Type.—No. 47721, U.S.N.M.

The new genus *Cœlocephalus* differs from *Cœlorhynchus* only in having the second dorsal spine serrate. It is of doubtful value, especially in view of the rudimentary serræ present on the second dorsal spine of *Coelorhynchus gladius*.

MACROURUS ECTENES, new species.

(Plate XLIV, fig. 1.)

Related to *M. rudis*.

Head $7\frac{1}{3}$; depth about $9\frac{1}{2}$. First dorsal I, 10; second dorsal low; pectorals about 22; ventrals 9.

Head compressed, deep, its sides vertical. Snout short, $1\frac{2}{3}$ in orbit,

scarcely extending beyond mouth, its anterior profile subvertical, its tip distant from premaxillaries one-half length of orbit. Tip of snout a small prominent spinigerous tubercle; a much smaller tubercle at each side of it. A median ridge extends backward from the tubercle to about the middle of the interorbital space, and at each side a smaller ridge from the minute lateral tubercles, above the nostril and coalesces with the superior orbital rim. A small spineless groove between the median and each of the lateral ridges. Interorbital space $1\frac{3}{5}$ in orbit, flat or a little concave. Orbit very large, $2\frac{2}{5}$ in head, elliptic in shape, its greatest diameter obliquely downward and backward. Mouth small, maxillary reaching about to front of pupil, one-half length of snout and eye. Teeth in villiform bands in both jaws. Angle of preopercle not produced backward. Barbel small, scarcely half the diameter of orbit. Gill membranes rather broadly united, with a narrow free fold behind. Anterior gill slit very short, about 3 in diameter of orbit. Body compressed, its width about one-half its depth. Tail very slender. Scales somewhat deciduous, small, very thin and flexible, with 3 or 4 slender, flexible spinelets (on a scale from side of back, near first dorsal fin). Scales on cheeks and top of head with from 1 to 3 spines in a single series, those on opercles with about 8 or fewer spines, usually in 3 parallel series. Spines on head shorter, suberect. About 10 or 11 scales in a transverse series between lateral line and origin of first dorsal. Interorbital space, upper side of snout, infraorbital ring, cheeks and opercles, scaly. Second dorsal spine serrate. Base of first dorsal a little greater than interorbital space. Interspace between dorsals short, about equaling base of first dorsal. Pectorals $1\frac{3}{5}$ in head. Outer ventral rays elongated (but broken off in the single specimen). Distance from tip of snout to origin of anal only twice the depth. Origin of anal under middle of first dorsal; its distance from base of ventrals five-sixths diameter of eye. Distance from vent to isthmus about half length of head, vent nearer anal than ventrals.

Color (in alcohol).—General color brownish black. Abdomen jet black. Mouth and gill cavity dusky or blackish. Fins dusky. Peritoneum black.

One specimen, $5\frac{1}{4}$ inches long, from station 3473; 313 fathoms.

Type.—No. 47718, U.S.N.M.

MACROURUS PROPINQUUS, new species.

(Plate XLII, fig. 2.)

Head $5\frac{1}{5}$ to $5\frac{3}{5}$; depth $6\frac{1}{4}$. B. 7. First dorsal I, 13; pectorals 21 to 22; ventrals 16.

Head rather large. Snout short, broad, overhanging mouth but little, its anterior profile nearly vertical, its length $1\frac{1}{8}$ in orbit; a small median spinigerous tubercle at the tip and an indistinct one at each side: the median tubercle nearly on a level with upper margin of orbit.

Interorbital space a little convex, about $1\frac{1}{3}$ to $1\frac{1}{4}$ in orbit. Orbit subcircular, 3 to $3\frac{1}{3}$ in head. Mouth small, transverse, with but little lateral cleft, the maxillary reaching nearly to middle of pupil, about 3 in head. Teeth in both jaws in villiform bands, the outer premaxillary series somewhat longer than those behind, but only indistinctly differentiated from them. Vertical edge of preopercle not serrulate. Barbel moderate, $1\frac{1}{2}$ in orbit. Gill membranes broadly united, almost without free fold behind. Anterior gill slit very short, about one-half diameter of orbit. Width of body about one-half its depth. The dorsal profile rises gently from tip of snout to origin of first dorsal, descending abruptly under this fin, thence nearly straight to end of tail. Ventral outline slightly convex. Scales rather small, quite deciduous, those on upper part of side near dorsal fin with about 25 moderate spinelets arranged in 7 to 8 parallel rows. Fourteen scales in a transverse row between lateral line and origin of first dorsal. The interorbital space, upper side of snout, under sides of rami of lower jaw, infraorbital ring, cheeks, and opercles completely scaled. Second dorsal spine serrate, moderately prolonged in a filament, the length of which can not be given owing to mutilation; base of first dorsal equal to orbit, distance between dorsals three-fourths base of first dorsal. Pectorals near axis of body $1\frac{2}{3}$ in head, somewhat mutilated. Outer ventral ray prolonged into a filament, about as long as head. Distance from tip of snout to origin of anal about 4 in total. Vent about halfway between base of ventrals and origin of anal.

Color (*in alcohol*).—Brownish; inside of mouth and gill cavities, branchiostegal membranes, and belly black; ventral fin and distal part of first dorsal fin dusky; ventral filament and the other fins pale. Peritoneum silvery, washed with dark brown.

This species differs from *M. holocentrus* in its more numerous ventral rays, smaller scales with fewer and more regularly arranged spinelets, in its dorsal profile, longer barbel, etc.

Two specimens, 6 and $7\frac{1}{2}$ inches long, from stations 3473 and 3475; 313 and 351 fathoms respectively.

Type.—No. 47741, U.S.N.M.

MACROURUS HOLOCENTRUS, new species.

(Plate XLIII.)

Head about $4\frac{2}{3}$; depth about 6; B. 7. First dorsal I, 11 or 1, 12; second dorsal low; anal rays well developed; pectorals 20 to 21.

Head quite firm, compressed. Snout very nearly equal to orbit, projecting axially beyond mouth for about half that distance, its lower profile very oblique; in shape obtusely conical, with a median and two smaller lateral spinous tubercles in front, the median tubercle nearly on a level with upper margin of orbit. Interorbital space nearly flat, narrow. $1\frac{1}{2}$ in orbit. Mouth small with lateral cleft. Premaxillaries anteriorly below level of pupil. Maxillary reaching not quite to center

of orbit, about 3 in head. Teeth in villiform bands on both jaws, the outer series of premaxillary teeth longer than the inner, but not canine-like; mandibular teeth smaller. Orbit $3\frac{1}{8}$ in head, its upper margin near the profile. Posterior edge of preopercle nearly vertical, slightly serrulate. Barbel small, scarcely more than one-third diameter of orbit. Gill membranes broadly united with a very narrow free fold behind. Anterior gill slit very short, $2\frac{1}{3}$ to $2\frac{1}{5}$ in diameter of orbit. Body compressed, its width about one-half its depth. Scales of moderate size, not very deciduous, with 25 to 50 very long slender backwardly directed spinelets arranged in about 8 to 10 somewhat irregular parallel series; 9 to 10 scales in a transverse row between origin of first dorsal and lateral line. Interorbital space, upper side of snout, infraorbital ring, under sides of lower jaw, cheeks, and opercles completely scaled. Anterior part of lateral line with a strong convex curve reaching middle of sides slightly in advance of origin of second dorsal. Second dorsal spine serrate, prolonged into a filament, its length slightly less than head. Base of first dorsal much greater than interorbital space, nearly equal to orbit. Distance between dorsals equal to twice the base of first dorsal. Pectorals near axis of body, slender, about $1\frac{4}{5}$ in head. Outer ventral ray prolonged in a slender filament, twice as long as the other rays, which reach origin of anal. Origin of anal nearly under middle of interspace between dorsals. Vent twice as far from origin of anal as from axils of ventrals. Distance from base of ventrals to origin of anal equal to length of snout. A small, round, naked pit between bases of ventrals, its width about one-third diameter of pupil.

Color (in alcohol).—Light brownish, with minute dark punctulations. Lips, branchiostegal membranes, mouth and gill cavities, and lower half of sides of trunk brownish black. Abdomen bluish black. First dorsal and ventral fins blackish, the ventral filament white; basal portion of anterior anal rays, blackish; axil of pectorals black, the fins slightly dusky. Peritoneum silvery, washed and dotted with brownish black.

Three specimens, $6\frac{1}{2}$ to $7\frac{1}{2}$ inches long, from stations 3474 and 3475; 375 and 351 fathoms, respectively.

Type.—No. 47734, U.S.N.M.

MACROURUS GIBBER, new species.

(Plate XLIV, fig. 2.)

Head $6\frac{1}{4}$; depth about $5\frac{1}{2}$; B. 7. First dorsal I, 11 or I 12; second dorsal very low; anal rays well developed; pectorals 20; ventrals 12 to 13.

Head compressed, deep, its greatest depth nearly equal to its length; cheeks vertical. Snout short, but little overhanging the mouth, its length a little less than diameter of orbit; its tip is a small, spiny

tubercle, on a level with the upper rim of the orbit; behind this a median ridge running up on the interorbital space; on each side, in line with the upper rim of the orbit, is another smaller ridge parallel with the median one, and ending anteriorly in a small, spinous tubercle. The infraorbital ridge is nearly vertical and ends under middle of orbit. Space between tip of snout and upper jaw nearly vertical. Interorbital space flat, very nearly equal to horizontal diameter of orbit. Orbit moderate, its longest axis nearly vertical, with a slight obliquity downward and backward, $3\frac{1}{2}$ to $3\frac{2}{5}$ in head. Mouth very oblique, maxillary scarcely reaching front of pupil; the tip of the premaxillaries nearly on a level with the center of the eye. Teeth in narrow villiform bands in both jaws. Angle of preopercle not produced, its posterior edge nearly straight, directed upward and backward. Barbel 1 to $1\frac{1}{2}$ in orbit; gill membranes narrowly united, without distinct free fold. Length of anterior gill slit $1\frac{1}{2}$ in orbit.

Body compressed, very deep, its greatest depth at origin of first dorsal equal to or greater than the length of the head. The dorsal profile ascends somewhat to origin of first dorsal, drops abruptly under this fin, which is therefore attached to the posterior slope of a prominent hump, and then runs nearly straight. The ventral profile ascends rapidly backward from origin of anal; hence the tail is abruptly narrower than trunk, but tapers uniformly to its tip. Scales, small, thin, and flexible, deciduous; about 14 in a transverse series between lateral line and origin of dorsal. Scales from back, behind origin of second dorsal, with 13 to 17 small spinelets arranged in about 5 or 6 nearly parallel rows; a scale from back in front of first dorsal with about 9 spinelets in 3 rows. Top and sides of head scaly. Second dorsal spine serrate for about one-third of its length, prolonged into a filament, its whole length $1\frac{3}{5}$ times as long as head. Base of first dorsal equal to orbit, $1\frac{1}{4}$ in the distance between the dorsals. Pectorals slender, three-fourths as long as head. Outer ventral ray prolonged into a filament which reaches much beyond origin of anal, about 2 in head. Origin of anal slightly in advance of origin of first dorsal. Distance from base of ventrals to origin of anal two-thirds of long diameter of orbit. Vent nearer origin of anal than base of ventrals.

Color (in alcohol).—Body brownish; snout light, translucent; lips, mouth cavity, under side of head, and lower side of trunk black. A vertical bar of same color on cheek behind angle of mouth, not reaching the orbit. Lining of gill cover black, with the exception of an oblong space at base of inner branchiostegal ray, which is silvery white. Lining of clavicular portion of gill cavity dusky or whitish. Pectoral and ventral fins dusky. Peritoneum dark brownish, silvery.

Seventeen specimens, $5\frac{1}{2}$ to $8\frac{1}{2}$ inches long, from stations 3474 and 3475; 375 and 351 fathoms, respectively.

Type.—No. 47733, U.S.N.M.

HYMENOCEPHALUS ANTRÆUS, new species.

(Plate XLVI, fig. 2.)

Head 5¾ to 6¼; depth 8 to 8½; B. 7. First dorsal I, 9 to I, 11; pectorals 13 to 16; ventrals 12.

Head large, squarish, its cavities greatly developed, roofed over by very thin membrane; the bones very thin, translucent and flexible. Sides of head vertical; snout very short, bluntly rounded, with slightly projecting median point, below which the profile is vertical; snout about 2 in vertical diameter of orbit. Interorbital space flat, 1½ in vertical diameter of orbit, 3⅛ to 3⅜ in head. Orbits and nostrils with prominent bony rims; most of head covered by a translucent integument, the shrinkage of which makes the bones unduly prominent. Mouth terminal, not overpassed by snout, somewhat oblique, the lower jaw included; maxillary reaching beyond hinder edge of orbit, 2 in head. Teeth small, in very narrow villiform bands on both jaws. Those on sides of lower jaw sometimes in a single series. Orbit very large, its horizontal diameter 2⅜ in head, its vertical diameter 2¼ in head, its upper edge entering the profile. Angle of preopercle rounded, its posterior edge vertical. Barbel wanting or excessively minute. Gill membranes united in front, not attached to isthmus. First gill slit nearly equal to diameter of orbit. Body moderately compressed, its width about two-thirds of the depth. Tail very slender. Trunk and tail tapering almost uniformly from head to tip of caudal. Scales very deciduous, large, very thin and flexible, cycloid, smooth; about 5 rows between lateral line and origin of first dorsal. The scales that were still in place were very few, but the above description applies to scales studied in position on the shoulder, on the back in front of first dorsal, on upper part of side below first dorsal, on lateral line, and on belly behind the base of the ventrals. Second dorsal spine smooth. Base of first dorsal equal to interorbital space; distance between dorsals about equal to twice the base of first dorsal. Pectorals very narrow and slender, 1⅛ in head. Base of ventrals under pectorals, rays slender, the outermost elongated into a filament reaching much beyond origin of anal. Distance from tip of snout to origin of anal about 3¾ in total. Vent far back, just in front of origin of anal. Distance from vent to isthmus at least as great as length of head.

Color (in alcohol).—Trunk dark brown; tail light, marked with darker brown; a line of dark-brown dots along axis of tail and a dark mark at the base of each ray of anal and second dorsal fins. Jaws, breast, and belly to origin of anal, intense black; sides of head and trunk silvery, washed with blackish. Gular membrane translucent, with a network of brown lines; lateral portions of isthmus, and a streak extending from them posteriorly above base of ventrals, silvery, crossed by extremely fine parallel brown lines, hardly to be distinguished without the aid of a lens. Base of first dorsal dusky, fins otherwise pale. Inside of mouth dusky or blackish. Peritoneum

silvery or blackish silvery. The typical deep-sea characters are very marked.

Ninety-one specimens, $3\frac{1}{4}$ to 7 inches long, from stations 3467, 3470, 3471, and 3476; 310, 343, 337, and 298 fathoms respectively.

Type.—No. 47735, U.S.N.M.

TRACHONURUS SENTIPELLIS, new species.

(Plate XLV, fig. 1.)

Head about $6\frac{1}{3}$; depth about 8. First dorsal I, 8; pectorals 16 to 17; ventrals 7; second dorsal low; anal rays well developed.

Head compressed, squarish, the sides vertical. Snout short, obtusely conical, overhanging the mouth but little, without tubercles, a little shorter than orbit. Interorbital space flat, a little greater than diameter of orbit. Orbit moderate, nearly circular, $3\frac{3}{5}$ in head. Mouth lateral, entirely below lower rim of orbit, maxillary reaching a little beyond middle of orbit. Teeth in villiform bands in both jaws; the outer series of the upper jaw slightly enlarged. Barbel small, about $2\frac{3}{5}$ in orbit. Gill membranes united with a broad free fold behind. Anterior gill slit short, about $2\frac{1}{4}$ in orbit. Scales firmly embedded, but distinct, imbricated, rather small; 8 scales in a transverse row between the lateral line and origin of first dorsal. Scales from the side above the lateral line with 10 to 11 long, strong spinelets frequently arranged in 3 radiating series; others from back behind origin of second dorsal and from side near origin of anal with about 8 spinelets similarly arranged; one from far back on tail with 9 spinelets in 5 series; others from the back in front of the first dorsal with 8 to 10 spinelets irregularly arranged. Spines on head and anterior part of body short and suberect; posteriorly becoming long, very slender, and closely appressed. Series of scales along the base of anal enlarged, each scale bearing a single oblique row of spines larger than those elsewhere on body. Posteriorly on tail and at extreme anterior end of anal these enlarged scales merge into the ordinary scales of the respective regions. Scales along base of dorsal not enlarged, some of them showing, however, a single oblique series of slightly enlarged spinelets. The whole head, except lips and gular and branchiostegal membranes, completely scaled. Second dorsal spine smooth, slender, $1\frac{2}{3}$ in head. Base of first dorsal a little more than half as long as orbit. Distance between dorsals about twice the base of the first dorsal. Pectorals narrow, about $2\frac{1}{6}$ in head. Ventral rays reaching about to origin of anal, the outer ray but little prolonged. Space between base of ventrals and origin of anal naked. Vent nearer the latter. Distance between base of ventrals and origin of anal two-sevenths of length of head. Origin of anal under middle of interspace between dorsals.

Color (in alcohol).—Dark brownish, darker anteriorly. Lips, mouth, and gill cavities, lining of esophagus and the belly, bluish black. Fins dusky, ventrals blackish. Peritoneum black.

This species is closely related to *Trachonurus villosus*, Günther, but differs from that in being less slender, in its larger eye, larger mouth, longer barbel, number of dorsal spines and pectoral rays, and in the number, character, and arrangement of the spinelets of the scales.

Two specimens, 11½ inches long, from station 3474; 375 fathoms.

Type.—No. 47980, U.S.N.M.

CHALINURA CTENOMELAS, new species.

(Plate XLV, fig. 2.)

Head 5¼; depth 6⅝; B. 7. First dorsal I. 10 to I. 12; pectorals 21; ventrals 9 to 10.

Head cavernous, compressed, cheeks nearly vertical; snout broadly triangular, tapering to a blunt point, short, projecting very little beyond mouth, 1⅛ in orbit, its tip nearly at the level of the upper margin of the orbits. Interorbital space slightly convex, without prominent ridges, 1½ in diameter of orbit, a slight infraorbital ridge extending from tip of snout to below posterior part of orbit. Mouth lateral, oblique, slightly overpassed by the snout, maxillary reaching nearly to vertical from hinder edge of pupil, 2⅛ in head. Premaxillary nearly as long as maxillary, heterodont, with an outer row of enlarged, widely set curved teeth, and an inner villiform band. Mandibular teeth in a very narrow band, smaller and more closely set than the outer premaxillary series. Orbit elliptical, large, 2¾ to 3 in head. Posterior edge of preopercle nearly vertical, a little incurved. Length of barbel 1 to 1⅛ in diameter of orbit. Gill membranes narrowly united, joined to the isthmus with a narrow free fold behind. Length of anterior gill slit equal to interorbital width. Body much compressed, its greatest width less than one-half the depth. Base of first dorsal elevated, oblique, its front projecting. Scales somewhat deciduous, of moderate size, with 15 to 20 sharp, slender spinelets, not in definite series, those on the scales of upper side of head and back and abdominal region mostly black. Whole snout, interorbital space, cheeks, opercles, and under side of lower jaw scaly; 10 rows between lateral line and origin of first dorsal. Second dorsal spine somewhat elongated, with 25 or 30 small serrations. Base of first dorsal equal to interorbital space; distance between the first and second dorsals twice or a little more than twice the base of the former. Distance from tip of snout to origin of anal about 4 in total length. Pectorals in axis of body a little more than half length of head. Ventral rays reaching a little beyond origin of anal, the outer rays produced into a short filament. Vent but little behind base of ventrals, distant from them about one-third its distance from front of anal. Distance between vent and isthmus more than half length of head.

Color (*in alcohol*).—Upper one-third of trunk and tail brownish; cheeks and lower two-thirds of sides silvery; sides and tail speckled

with brownish dots. Lips, under side of head, branchiostegal membranes, gill cavities, back part of mouth, distal part of first dorsal, base of pectoral, and most or whole of ventral fins brownish black. Ventral part of body from the isthmus to or beyond origin of anal bluish black; a faint dark elongate spot under the posterior part of orbit. Peritoneum bright silvery, dotted with black.

Young more slender, less deep, eye larger.

Seven specimens, 4¼ to 8 inches long, from stations 3470 and 3472; 343 and 295 fathoms, respectively.

Type.—No. 47704, U.S.N.M.

OPTONURUS ATHERODON, new species.

(Plate XLVI, fig. 1.)

Head 5; depth 5⅚; B. 7. First dorsal I, 10 to I, 11; anal about 130; pectorals 20 to 23; ventrals 10.

Series of large, cavernous pits and depressions on top of head; suprascapular region and preorbital covered with thin translucent integument. Head very cavernous, compressed. Snout broad, short, 1½ in orbit, its preoral portion 3 in orbit. Interorbital space flat, 1¼ to 1½ in orbit. A median ridge extending from behind tip of snout over the interorbital space to about opposite the middle of the orbits, where it joins a transverse ridge. The interorbital space between this ridge and edges of the orbits covered by a thin, translucent membrane beneath which are large cavities. A pair of small, curved ridges (with their convex sides directed medianward) on the occiput. Quite prominent bony rims around the nostrils. Mouth terminal, lateral, oblique, jaws about equal, the lower, little included, maxillary reaching middle of orbit, nearly half as long as head, its posterior end much narrowed and directed ventrally. Premaxillary nearly as long as maxillary, heterodont, with an outer series of widely set canines with distinctly arrow-shaped tips, and an inner villiform band. Mandibular teeth small, closely set in a very narrow band, the inner series slightly enlarged. Orbit very large, 3¼ in head, its upper edge nearly entering the profile. Preorbital narrow, 2⅖ in orbit. Posterior edge of preopercle nearly vertical, slightly incurved. Barbel a little more than one-half length of orbit. Gill membranes rather broadly united in a free fold across the isthmus. The length of the anterior gill slit 1⅓ to 1¼ times the interorbital width. Body compressed, its greatest width one-half its height. Scales very deciduous, of moderate size, thickly covered with short blackish spinelets not arranged in series. Head apparently entirely scaled; 10 to 12 series between origin of dorsal and lateral line. Second dorsal spine smooth, 1¾ in head. Base of first dorsal equal to interorbital space. Origin of first dorsal over axil of pectorals. Second dorsal low; distance of its origin from end of first dorsal nearly three times the base of the latter. Origin of anal under or slightly in

front of end of first dorsal; its distance from base of ventrals one-third to one-fourth of length of head. Pectorals in axis of body narrow, slightly more than half length of head. Outer ray of ventrals produced into a filament which reaches beyond origin of anal. Vent well forward, immediately behind base of ventrals; no naked pit between bases of ventrals. Distance between vent and isthmus more than half length of head.

Color (in alcohol).—Cheeks, opercles, and lower two-thirds of sides silvery; the sides, especially on tail, speckled with minute dark dots. Upper one-third of sides brownish, the line between the brown and the silvery of the sides sharply defined. Snout, lips, lower side of head, branchiostegal membranes, gill cavities, and posterior part of mouth cavity brownish black. A brown band from eye backward and downward across cheeks. A fainter band from eye along upper edge of cheeks and opercles; a third band seen through the transparent membrane covering the infraorbital ring; narrow posterior margin of premaxillary velum black; a small black blotch either side of vomer. Ventral side of body from isthmus to or a little beyond origin of anal bluish black. Pectoral and ventral fins dusky. Peritoneum bright, silvery, somewhat dotted with black specks.

Thirty specimens, 5½ to 13¼ inches long, from stations 3470, 3471, 3474, 3475, and 3476; 343, 337, 375, 351, and 298 fathoms, respectively.

Type.—No. 47729, U.S.N.M.

MALACOCEPHALUS LÆVIS, Lowe.

Hitherto recorded only from the Atlantic, and from Andaman Sea (Alcock).

Ten specimens, the smallest 12¾ inches, from stations 3470, 3472, 3475, and 3476; 343, 295, 351, and 298 fathoms respectively.

Family PLEURONECTIDÆ.

PELECANICHTHYS, new genus.

Eyes and color on the left side. Mouth symmetrical, of enormous extent, gape about as long as head. Mandibles extending anteriorly far beyond tip of snout, the projecting portion decurved and falciform; the rami very slender and flexible, each rotating inward, so that the teeth of the two rami meet and interlock in the closed mouth, instead of being opposed to those of the upper jaw. Mandibular membranes voluminous, forming a veritable gular pouch and permitting wide divarication of the mandibular rami, which can be also closely apposed for their entire length. The angular forms a slender process, projecting beyond the mandibular articulation and extending behind the posterior margin of the opercle. Premaxillary, maxillary, and palatopterygoid formed of three very slender bony rods, parallel and closely juxtaposed for the greater part of their length. Branchiostegals 7.

Gill rakers absent. Preopercular margin free. Dorsal and anal fins very long, the former commencing on the snout. Caudal peduncle extremely short, a low fin-fold joining dorsal and anal with rudimentary caudal rays. Caudal lanceolate. Ventrals unsymmetrical, the left slightly more anteriorly placed, inserted on the ridge of the abdomen, its membrane leading to base of first anal ray. Vent displaced well to the right side of the ridge slightly in advance of front of anal, a small papilla (genital papilla?) occupying a corresponding position to the left of the ridge. Scales excessively fine. Lateral line single, conspicuous, continued on to the caudal fin; with a short, low anterior arch.

PELECANICHTHYS CRUMENALIS, new species.

(Plate XLVII.)

Head (horizontal length) $4\frac{1}{8}$ to $4\frac{1}{2}$ ($5\frac{1}{4}$ in smallest specimen); depth $3\frac{1}{2}$ to $3\frac{3}{5}$ (4 in smallest); dorsal 121; anal 88; pectorals 13 or 14; ventrals of both sides with 6 rays; about 230 to 240 pores in the course of the lateral line.

Body slender, excessively compressed, tapering slowly and uniformly toward tail, the two outlines very weakly arched for the greater part of their extent. Anterior outline of head strongly decurved, the physiognomy resembling that of *Glyptocephalus*. Bases of dorsal and anal fins wide, translucent, sharply marked off from rest of body, constituting together half the greatest depth of body. Abdomen very short.

Head very obliquely placed, the eyes closely approximated near the upper anterior profile, the cheeks narrow, oblique, the upper limb of preopercle nearly horizontal, the lower limb nearly vertical. Mandible extending beyond premaxillaries for over one-fourth its length. The rami are so articulated as to permit a slight inward and outward rotation on their long axes, in addition to other movements. The gular membrane is large and loose, falling into folds when the jaws are closed. The entire mechanism of the lower jaw seems adapted to seizing food between the rami, and forcing it down between and below them. Teeth in both jaws in a somewhat uneven single series, those in mandible largest, smaller teeth irregularly alternating with the larger ones in both jaws. Posterior third of both jaws toothless. Palate smooth. Anterior nostril with an overarching flap or short tube. Posterior nostril without tube.

Eyes elliptical, nearly even, long axis of lower eye very oblique. Oblique diameter of upper orbit $3\frac{3}{4}$ in head; the snout short, five-sevenths diameter of upper eye. Interorbital space narrow, grooved, the width one-fifth diameter of upper eye.

Dorsal fin beginning above anterior nostril, the first few rays slightly displaced toward the blind side. Pectorals narrow, pointed, about $1\frac{3}{4}$ in length of head, that of blind side apparently shorter. Caudal lanceolate in a young specimen (mutilated in adult), the middle rays $1\frac{1}{4}$ in head.

Jaws, snout and interorbital space naked; head and body elsewhere covered with minute cycloid scales. Lateral line nearly axial, its anterior arch low, above the head, the posterior downward curve abrupt, above base of pectoral; length of arch nearly equal to half depth of body.

Color (in alcohol).—Head and body light brown, the outlines of the scales dusky, the wide bases of dorsal and anal fins semitranslucent. Abdomen in the adult with narrow vertical stripes of blue-black, alternating with the wider muscular bands which are of the ground color. Head and anterior median portion of trunk with faint darker brown spots about one-third size of pupil. In addition to these, the median part of body is marked with about 45 larger round spots, darker than the others, but still faint and ill defined. These are nearly as large as eye, and are arranged on anterior part of trunk in 7 lengthwise series, all but 3 of which gradually disappear on tail. The larger spots are much more distinct in young specimens than in adults. Mouth and gill cavity white. Peritoneum black. Fins dusky.

Three specimens, 7 to 10 inches long, from stations 3472 and 3476; 295 and 298 fathoms, respectively.

Type.—No. 48738, U.S.N.M.

Family MALTHIDÆ.

MALTHOPSIS MITRIGER, new species.

(Plate XLVIII, figs. 1, 2.)

Branchiostegals 4; dorsal I, 4 to 5; anal 4; pectorals 14; ventrals I, 5; pores of lateral line behind disk 9.

The disk strongly depressed, triangular, its greatest width (exclusive of the posterior lateral projections) $1\frac{3}{8}$ in length of body exclusive of caudal, its depth about 4. Body behind disk tapering nearly uniformly. Body nearly everywhere covered with radially striated tubercular plates. Gular region and branchiostegal membranes naked. The vent lies in the center of a naked, somewhat elliptical basin surrounded by a ridge of tubercles. A shallow pit behind base of ventrals. Head vertical in front. The tentacular pit triangular, higher than wide, its upper angle on a level with the upper edge of pupil. The pit is surmounted by a large, conical median tubercle projecting upward and slightly forward, the length of which is about 2 in orbit. At each side of this tubercle is another smaller one projecting upward and outward. The club-shaped tentacle, when extended, not quite reaching front of upper jaw. Eyes large, the orbits strongly convergent, distance between their anterior edges $2\frac{1}{2}$ in the distance between their posterior edges. Mouth somewhat oblique; bands of very minute teeth on jaws, vomer, and palatines. Width of mouth and diameter of orbit about equal. Gills 2 on each side, only a narrow membrane on first

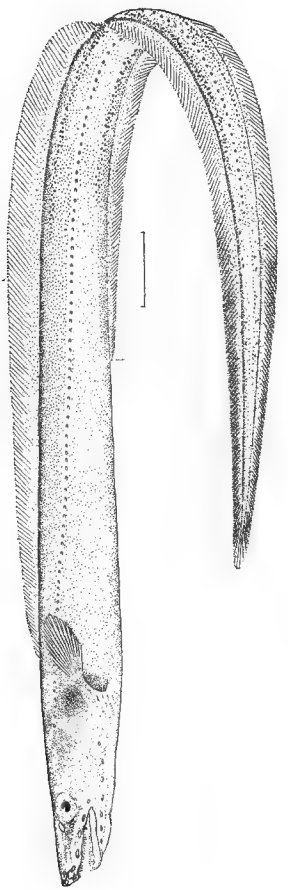
arch; gill rakers minute. Subopercular spine flat, long, extending laterally and armed at tip with 2 to 5 small spinelets. Pectorals about 4½ in length of body, the rays very close-set; ventrals about 7 and caudal 6 in length of body. Vertical fins weak.

Color (in alcohol).—Body and all the fins pale, yellowish. Peritoneum dusky.

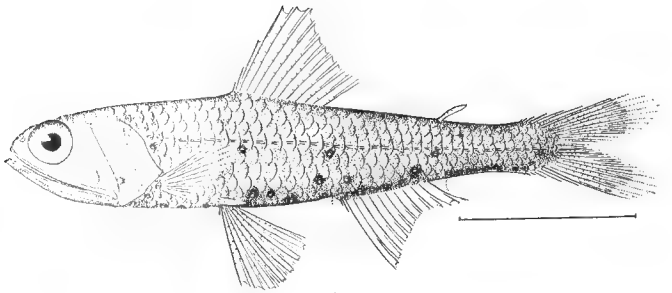
Length, 3 inches.

Stations 3467, 3472, and 3476; 310, 295, and 298 fathoms, respectively.

Type.—No. 47700, U.S.N.M.



CONGERMURÆNA ARQUOREA.



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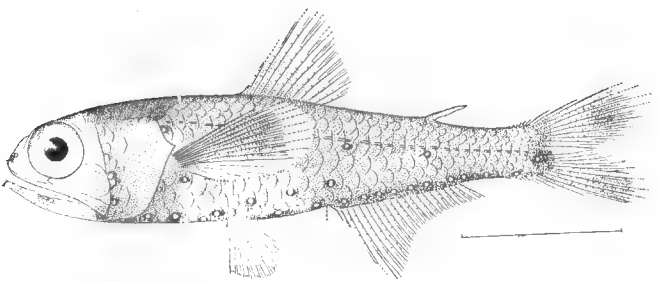

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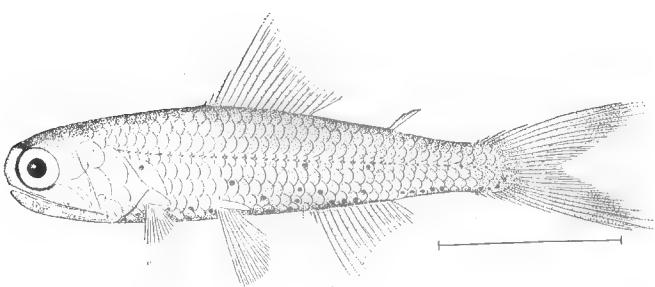
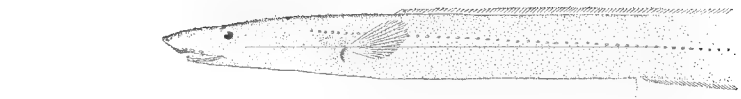


3

NEW FISHES FROM THE PACIFIC OCEAN.

FIG. 1. *Diaphus urolampus.*
FIG. 2. *Diaphus chrysorhynchus.*
FIG. 3. *Myctophum fibulatum.*



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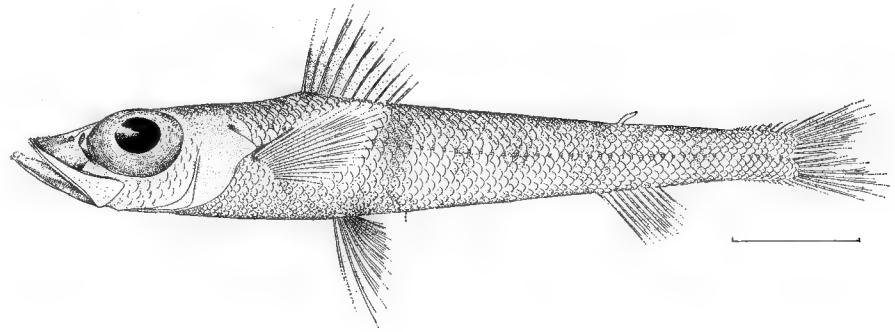
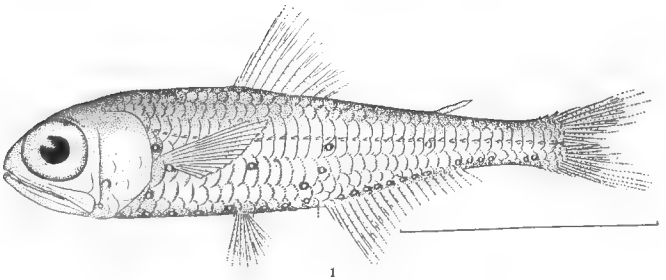


2

NEW FISHES FROM THE PACIFIC OCEAN.

FIG. 1. *Promyllantor alcocki.*

FIG. 2. *Chlorophthalmus proridens.*



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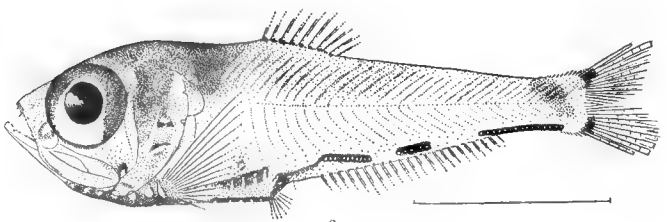

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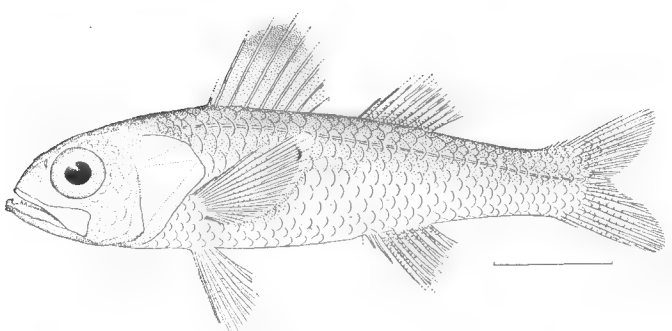
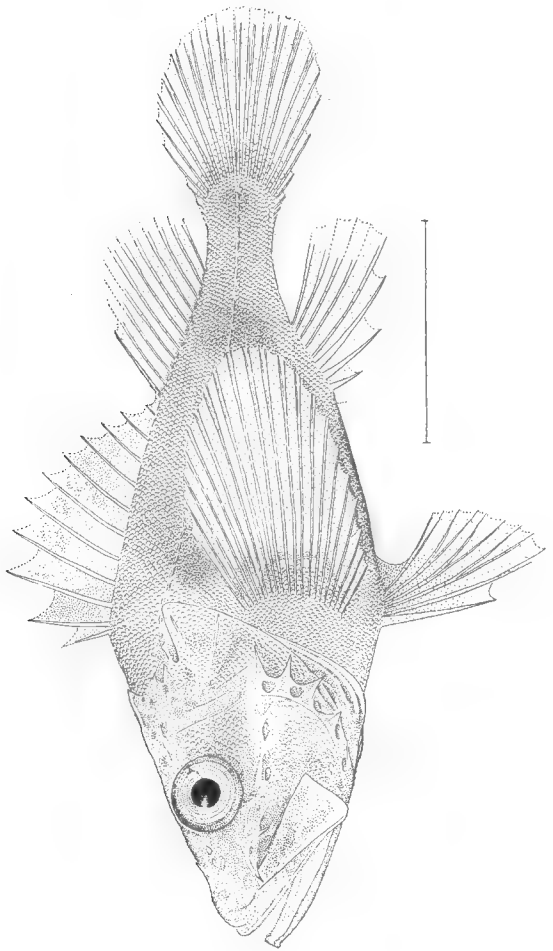


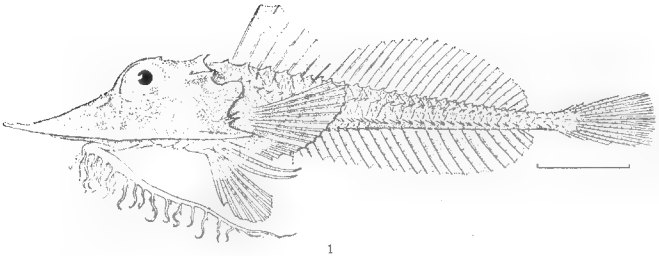
3

NEW FISHES FROM THE PACIFIC OCEAN.

FIG. 1. *Dasyscopelus pristilepis*
FIG. 2. *Argyripnus ephippiatus.*
FIG. 3. *Melanostoma argyreum.*



SCORPÆNA REMIGERA.



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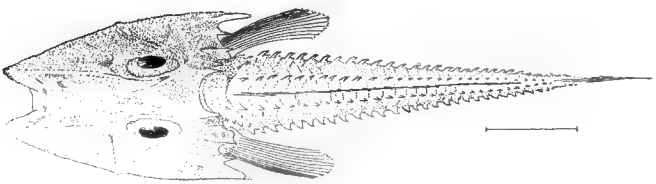

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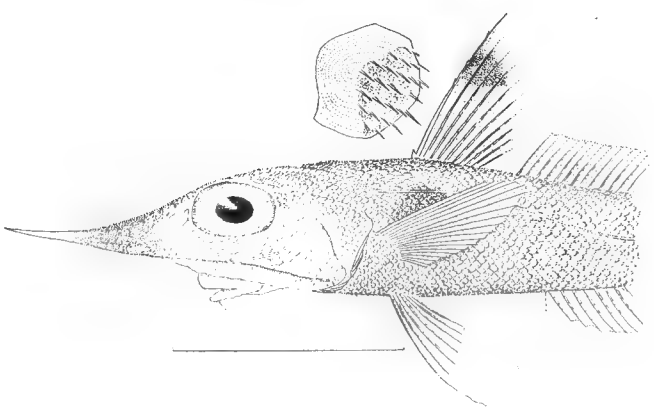
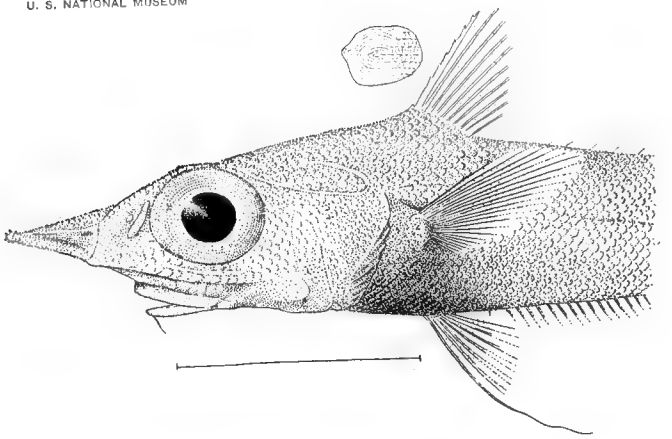


3

NEW FISHES FROM THE PACIFIC OCEAN.

FIGS. 1–2. *Peristedion bians.*
FIG. 3. *Coelorhynchus gladius.*



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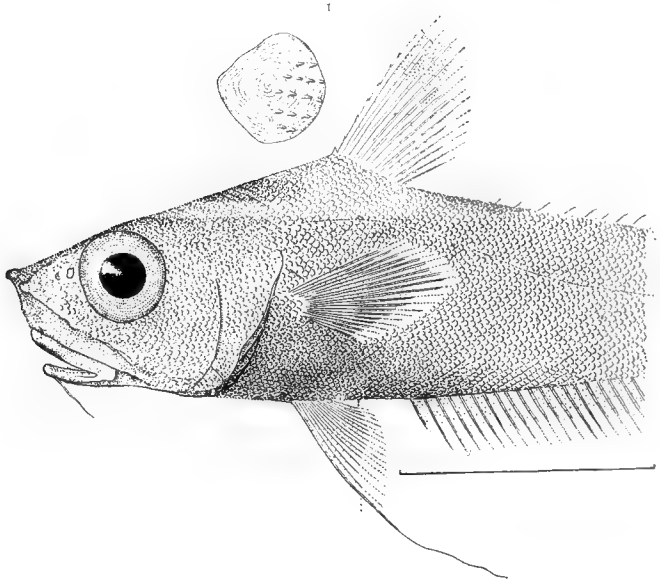
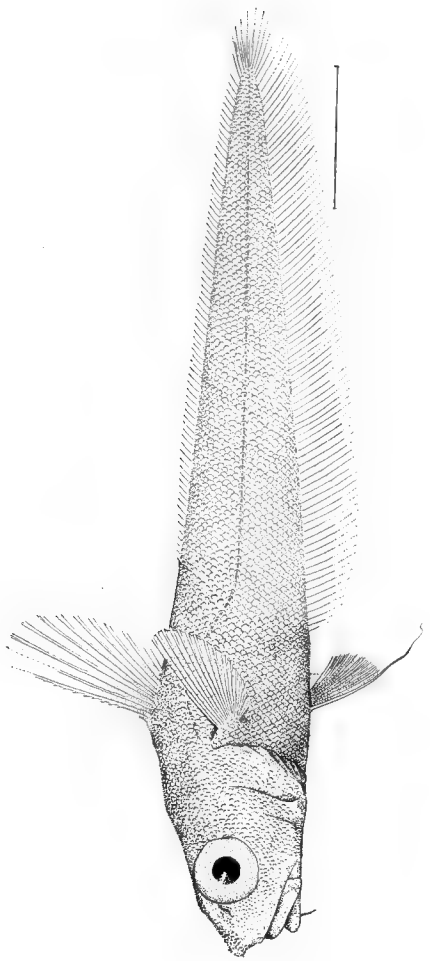


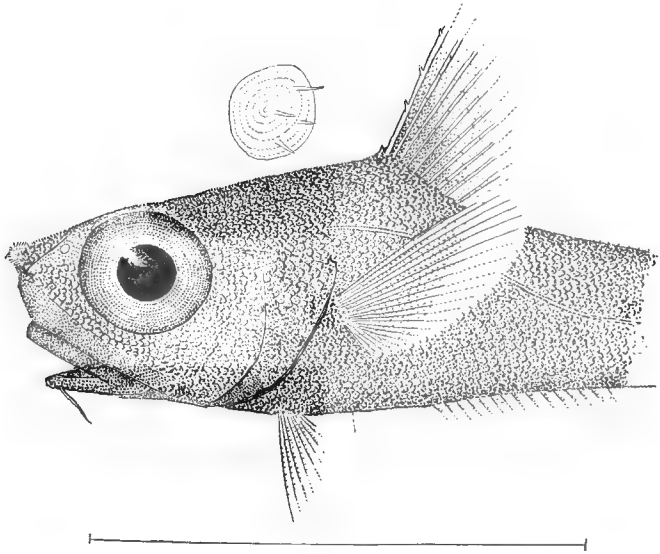
2

NEW FISHES FROM THE PACIFIC OCEAN.

FIG. 1. *Cadocephalus acipenseriuus.*
FIG. 2. *Macrurus propinquus.*



MACROURUS HOLOCENTRUS.



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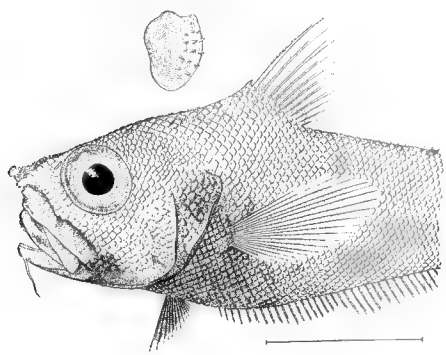
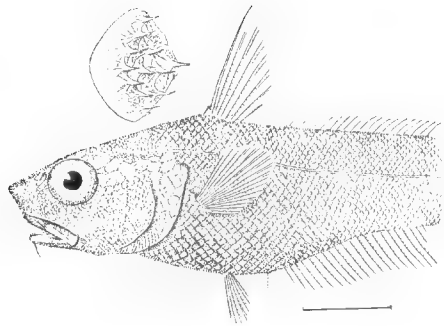


2

NEW FISHES FROM THE PACIFIC OCEAN.

FIG. 1. *Macrourus ectenes.*
FIG. 2. *Macrourus gibber.*



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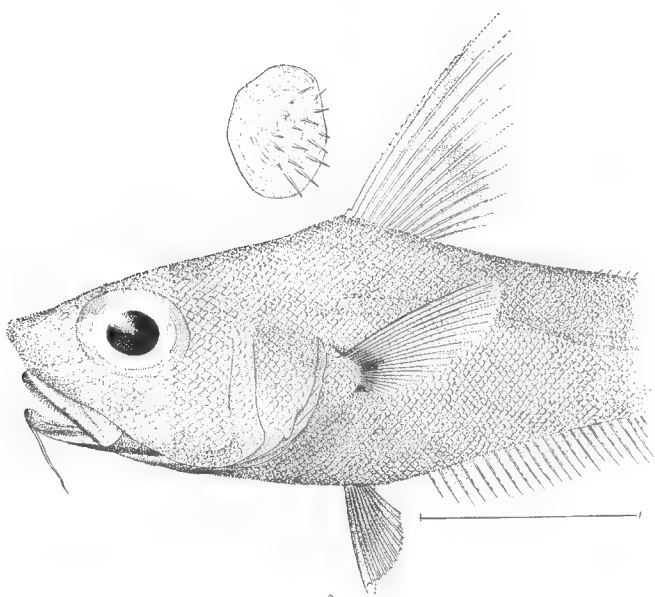
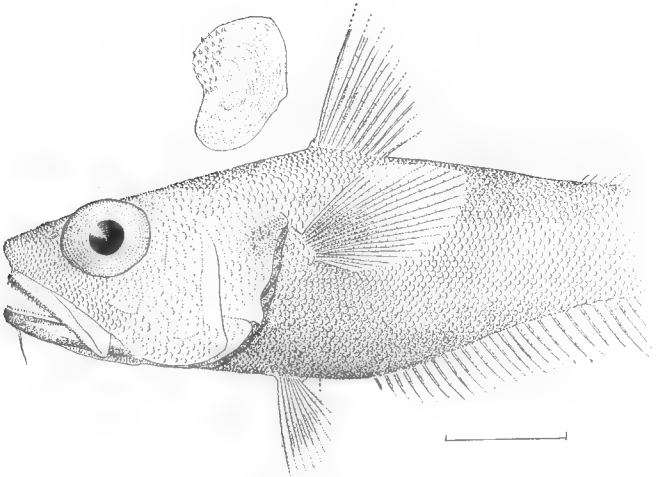


2

NEW FISHES FROM THE PACIFIC OCEAN.

FIG. 1. *Trachonurus sentipellis.*
FIG. 2. *Chalinura ctenomelas.*



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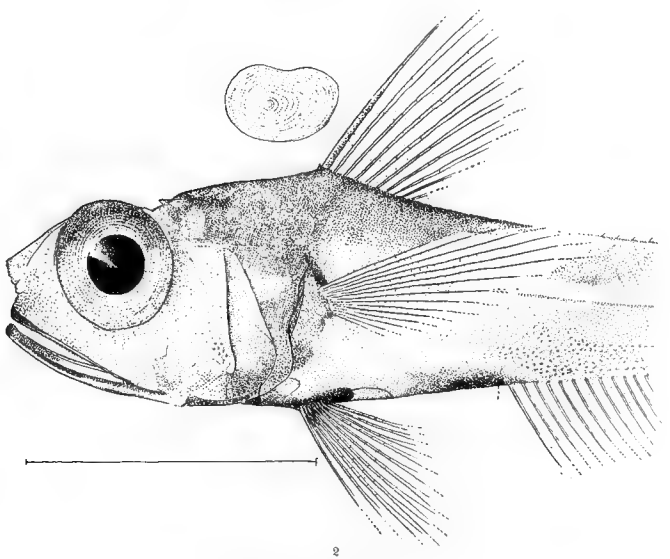
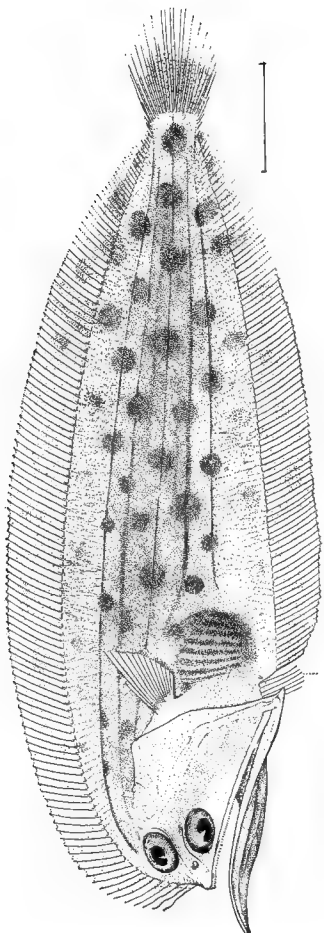


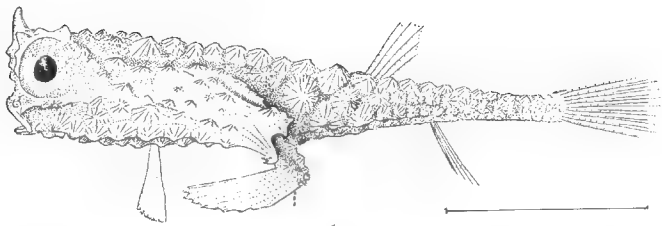
2

NEW FISHES FROM THE PACIFIC OCEAN.

FIG. 1. *Optonurus atherodon.*
FIG. 2. *Hymenocephalus antræus.*



PELECANICHTHYS CRUMENALIS.



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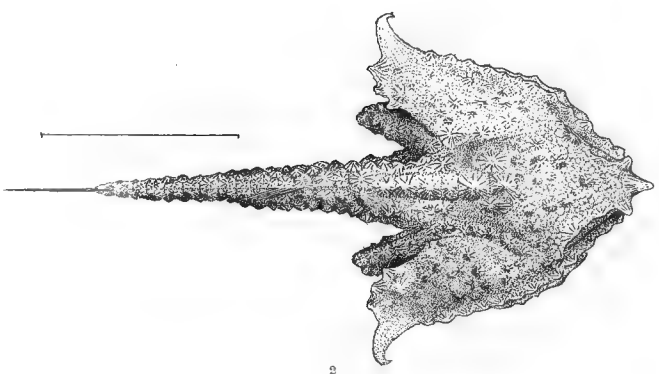


2

NEW FISHES FROM THE PACIFIC OCEAN.

Malthopsis mitriger.

FIG. 1. Lateral view. FIG. 2. Dorsal view.

DESCRIPTIONS OF TWENTY-TWO NEW SPECIES OF FISHES COLLECTED BY THE STEAMER ALBATROSS, OF THE UNITED STATES FISH COMMISSION.

By CHARLES HENRY GILBERT,

Professor of Zoology, Leland Stanford Junior University.

IN THE study of the different collections of fishes from the *Albatross* explorations, by Doctor Jordan and the writer, certain aberrant specimens have been set aside for further comparison. All these specimens have been lately reexamined, and among them 14 species are found which seem to be new to science. These species are here described, each in the name of the person responsible for the determination and the description:

List of species described.

1. *Tachysurus liropus,* S. B. Bristol. San Juan Lagoon, Sonora, Mexico.
2. *Netuma insularum,* Flora Hartley Greene. Galapagos Archipelago.
3. *Leuresthes crameri,* Jordan and Evermann. Ballenas Bay, Lower California.
4. *Mugil thoburni,* Jordan and Starks. Galapagos Archipelago.
5. *Myripristis clarionensis,* Gilbert. Clarion Island.
6. *Centropomus constantinus,* Jordan and Starks. Bahia, Brazil.
7. *Epinephelus niphobles,* Gilbert and Starks. Magdalena Bay, Lower California.
8. *Orthopristis forbesi,* Jordan and Starks. Galapagos Archipelago.
9. *Ophioscion strabo,* Gilbert. San Juan Lagoon, Sonora, Mexico.
10. *Holacanthus iodocus,* Jordan and Rutter. Galapagos Archipelago.
11. *Xesurus clarionis,* Gilbert and Starks. Clarion Island, Mexico.
12. *Scorpæna pannosa,* Cramer. Panama.
13. *Sebastodes semicinctus,* Gilbert. Santa Barbara Channel, California.
14. *Sebastodes ayresii,* Gilbert and Cramer. Cortez Banks, Mexico.
15. *Sebastodes crameri,* Jordan. Coast of Oregon.
16. *Prionotus loxias,* Jordan. Bay of Panama.
17. *Astroscopus zephyrius,* Gilbert and Starks. Magdalena Bay, Lower California.
18. *Emmnion bristolæ,* Jordan. Galapagos Archipelago. (EMMNION, new genus.)
19. *Ulvicola sanctæ-rosæ,* Gilbert and Starks. Santa Cruz Island, California. (ULVICOLA, new genus.)
20. *Emblemaria oculocirris,* Jordan. La Paz Harbor.
21. *Lepidion verecundum,* Jordan and Cramer. Clarion Island.
22. *Paralichthys woolmanni,* Jordan and Williams. Galapagos Archipelago.

Family SILURIDÆ.

TACHYSURUS LIROPUS, S. B. Bristol, new species.

Allied to *Tachysurus melanopus* (Günther).

Head $3\frac{3}{4}$ to $3\frac{3}{4}$; depth $4\frac{3}{5}$ to $5\frac{1}{10}$; dorsal I, 6; anal 2, 19; pectorals I, 9 or 10.

Body elongate, its width anteriorly a little less than depth; the posterior portion much compressed; the back elevated at front of dorsal; anterior profile from front of dorsal to tip of snout oblique. Head flat, very broad, its width $1\frac{1}{2}$ in its length. Snout broad, rounded, $1\frac{1}{10}$ to $1\frac{1}{6}$ in interorbital width. Eye rather large, laterally placed, its width about $1\frac{3}{5}$ in its length, $4\frac{1}{8}$ to $4\frac{9}{10}$ in head. Mouth small, upper jaw considerably projecting, its breadth $2\frac{3}{5}$ to 3 in head. Jaws thin; wide bands of minute pointed teeth present on both jaws. Vomerine bands widely separated and indistinguishable from the palatine band, which is small, oblong-ovate and scarcely prolonged backward; interval separating vomerine bands about $2\frac{1}{2}$ or 3 in eye; the teeth on these bands larger than those on jaws, and very bluntly conical. Interorbital space broad, $2\frac{1}{2}$ to 3 in head. Barbels long and slender, the maxillary barbel extending to, nearly to, or, in some cases, past base of pectoral, $1\frac{1}{14}$ to $1\frac{2}{5}$ in head; outer mental barbel $1\frac{1}{2}$ to $1\frac{3}{4}$ in head; inner mental barbels $2\frac{1}{8}$ to $2\frac{3}{5}$ in head. Dorsal shield very short, narrowly crescent-shaped; its length on the median line about 2 or 3 in its width. Occipital process subtriangular, a little longer than broad at base; its edge slightly concave; its median keel strong. The long, narrow groove of the fontanelle beginning abruptly a short distance in front of occipital keel, the distance from its end to base of dorsal $1\frac{3}{5}$ to 2 in the distance to tip of snout. Shields of head rather smooth, finely granular, the granules forming distinct lines anteriorly. The flat area between eyes triangular, with a median groove extending from fontanelle forward to tip of snout; its posterior end a little behind eye, the granulations on each side of it extending forward as far as posterior border of pupil. Opercles with no radiating striæ. Gill membranes forming a very narrow fold across the isthmus. Gill rakers 5+12. Nostrils large, placed close together and near tip of snout; the posterior with large flap. Axillary pore small, but evident, much smaller than nostrils. Humeral process smooth, short, 4 to $5\frac{1}{2}$ in pectoral spine. Base of dorsal $2\frac{3}{5}$ to $2\frac{6}{10}$ in head; dorsal spine long and very strong, $1\frac{1}{7}$ to $1\frac{1}{4}$ in head, its upper anterior serræ small and tubercle-like; its upper posterior and its lower edges retrorsely serrate; the soft rays extending considerably beyond the spine, $1\frac{1}{6}$ to $1\frac{1}{4}$ in head. Adipose fin small, its base $3\frac{1}{2}$ to $4\frac{1}{2}$ in head, its height $1\frac{3}{5}$ to 2 in its base. Caudal widely forked, the upper lobe, measured from base of caudal to its tip, the longer, about $1\frac{1}{4}$ in head. Base of anal $1\frac{3}{5}$ to $1\frac{2}{7}$ in head, its longest ray $2\frac{1}{4}$ to $2\frac{1}{3}$ in head. Ventrals reaching five-sixths to seven-eighths the distance to origin of anal; vent about midway between origin of ventrals and origin of anal.

Pectoral spine 1½ in head, serrate, the serræ on inner edge larger and sharper than those on outer, the upper anterior serræ tubercle-like; the rays a little longer than spine. Bluish silvery, light yellowish below; top of head and back brown. Fins dusky olive, lighter at base; all margined with darker; ventrals not black; similar in color to other fins; adipose fin covered with minute black dots. Maxillary barbels dark brown, with bluish silvery luster; other barbels lighter. Eye yellowish. Length 7¼ to 9 inches.

Type.—No. 47584, U.S.N.M.

Six specimens from San Juan Lagoon, near the mouth of Rio Ahome, Sonora, Mexico.

NETUMA INSULARUM, Flora Hartley Greene, new species.

Head in length 3⅗; width of head in length 4⅔; interorbital space in length 7; interorbital space in head scarcely 2; snout in head 3; breadth of mouth in head 2; eye in head 6⅔; dorsal I, 7; anal 17.

Head much broader than deep; snout depressed and broadly rounded; eye above the level of the mouth. Upper jaw projecting. Teeth on vomer and palatines villiform and bluntly conical. The 2 vomerine patches forming together a band almost as long and slightly broader than the premaxillary band; the 2 sides separated by a narrow interspace. Palatine teeth well separated from the vomerine teeth and in 2 large triangular patches which extend backward over the pterygoid region. Each triangle has a sharp notch in its anterior side; its anterior-posterior length is twice its lateral width. Teeth of lower jaw in a narrower band than the upper jaw. Maxillary barbel extending to end of first third of the length of the pectoral spine; outer mental barbel to base of pectoral; inner mental barbel past gill opening, 2⅓ in head. Dorsal shield crescent-shaped, without median keel. Length on median line 2⅔ in distance between the horns of the crescent; 2 notches on its anterior side to meet the corresponding points from the occipital process. Occipital process broadly triangular, with the outer sides concave and 2 small projections at its posterior end. Median keel evident, rather short. Occipital process much broader at base than long; its length 3½ in head; posterior breadth 2 in length of process. Fontanelle broad and shallow, narrowed gradually posteriorly to a point halfway between snout and base of dorsal spine. A narrow line runs back from it the distance of a long diameter of the eye. Greatest width of the fontanelle equals the short diameter of the eye. Shields of the head granular striate, the striæ evident and extending to the middle of the interorbital space, and on the side to meet the humeral process at the top of the gill opening. Opercles nearly smooth. Gill membranes forming a fold across the isthmus. Dorsal and pectoral spines crenulate in front and sharply retrorse serrate behind. Dorsal shorter than pectoral, which is 1⅓ in head. No axillary pore evident. Adipose fin long and low with posterior margin attached. Vent much nearer ventrals than anal.

Color (in alcohol).—Dark blue above, light blue on side, and white below; maxillary barbel dusky; fins all dusky.

Type.—No. 47577, U.S.N.M.

This species was collected by the *Albatross* in the Galapagos Archipelago, being part of the collection studied by Jordan and Bollman in 1889. It was recorded by them[1] as *Tachysurus elatturus* (var.?). Its relations to *Netuma elattura* are close, but its fins are larger and there are several differences in details of structure.

Family ATHERINIDÆ.

LEURESTHES CRAMERI, Jordan and Evermann.

Head $4\frac{1}{5}$; depth $5\frac{1}{5}$; eyes $3\frac{3}{4}$; snout $3\frac{1}{2}$; dorsal V–I, 8; anal I, 21; scales 5–67–6.

Body slender, gently rounded above, narrowed below. Scales smooth, firm, closely imbricated, the membranous edge strongly serrate. Mouth, moderate, premaxillaries very protractile; maxillary short, not reaching eye. First dorsal over front of anal, much nearer base of caudal than tip of snout, or midway between base of caudal and gill opening. Color hyaline green, with a lateral silvery streak, plumbeous above, narrow, its width $1\frac{1}{2}$ in eye, wider than one row of scales, covering one row and two half rows; body above lateral line covered with small brown specks; pectorals and caudal chiefly blackish; second dorsal with many black specks; anal and ventrals plain. Close to *Leuresthes tenuis*, from which it differs in the larger scales, smaller eye, shorter maxillary, and the much narrower lateral band. Length 5 inches. Ballenas Bay, Lower California, near Cape Abreojos. Several specimens collected by Dr. Charles H. Gilbert on the *Albatross*.

Type.—No. 47583, U.S.N.M.[2] Named for Frank Cramer, in recognition of his excellent work on the Scorpænidæ and Agonidæ.

This species is described as new in Jordan and Evermann, "Fishes of North and Middle America."

Family MUGILIDÆ.

MUGIL THOBURNI, Jordan and Starks, new species.

Head $3\frac{1}{2}$ to $3\frac{3}{4}$; depth 4; dorsal IV–7; anal III, 9; scales 44–15; orbit equal to snout, $4\frac{1}{2}$ in head; uncovered part of eye 8 or 9 in head; interorbital $2\frac{1}{3}$; first dorsal spine 2; soft dorsal and anal equal, the longest ray, $2\frac{1}{8}$; ventrals 2 in head; pectorals $1\frac{2}{3}$.

Body moderately elongate; a very gentle curve from tip of snout to dorsal; ventral outline considerably curved, the curve uniform from chin to caudal peduncle. Head large, broadly rounded above; eye moderate, with a large adipose eyelid; mouth oblique, the maxillary

[1] Proc. U. S. Nat. Mus., XII, 1889, p. 179.

[2] Transferred from the Leland Stanford Junior University Museum where it was numbered 27.

reaching to front of orbit; upper lip rather thick; lower jaw with a knob at the middle which fits into an emargination in the upper, its angle more obtuse than a right angle; space on chin between mandibular bones, broad in front, acute behind, the subopercles meeting below. Teeth very minute, scarcely appreciable. Preorbital minutely serrated. Pectorals reaching about to middle of end of ventrals, not to spinous dorsal; spinous dorsal inserted above posterior end of ventral when fin is depressed; first spine of dorsal the longest; soft dorsal and anal similar, their margins incised; ventrals inserted behind middle of pectoral; soft dorsal and anal scaly, 23 scales before dorsal.

Color slaty, bluish above, silvery below; sides with rather faint longitudinal bluish stripes which follow the rows of scales, fading out on the belly and running into the darker color on the back; ventrals and anal pale; pectoral and dorsals dusky; a dusky bar at base of pectoral.

Type.—No. 47576, U.S.N.M.[1] Two specimens, the largest 8 inches long, collected by the *Albatross* in the Galapagos. Close to *Mugil incilis*, the head larger, and with several minor differences. The species is named for Dr. Wilbur W. Thoburn, of Leland Stanford Junior University. It appears as a new species in "Fishes of North and Middle America," by Jordan and Evermann.

Family HOLOCENTRIDÆ.

MYRIPRISTIS CLARIONENSIS, Gilbert, new species.

(Plate LXIX.)

Differing from all known American species of *Myripristis* in having $3\frac{1}{2}$ series of scales between the lateral line and the base of the spinous dorsal, instead of $2\frac{1}{2}$. The scales are comparatively small (41 in the course of the lateral line). The color is dusky red, without black bars or any sharp markings.

Head $3\frac{1}{3}$ in length; depth $2\frac{2}{7}$. Least depth of caudal peduncle half length of snout and eye. Greatest (oblique) diameter of eye $2\frac{1}{4}$ in head. Least interorbital width equaling length of snout, $4\frac{1}{2}$ in head. Mouth less oblique than in related species, the line of upper jaw with a more pronounced double curve. Lower jaw the longer, with well-developed symphyseal knob. Teeth finely villiform, very slightly enlarged toward middle of both jaws. Wide patches of similar teeth on head of vomer and on palatine bones. Length of maxillary (measured from front of upper jaw) very slightly (about one-twentieth) less than length of snout and eye. D. X–I, 14; A. IV, 12. Scales $3\frac{1}{2}$–41–7.

Color before immersion in spirits, reddish, the upper parts dusky, especially on top of head and on the margins of the scales. Evident horizontal dusky streaks between the rows of scales. Opercular membrane blackish. Fins all light, without dark markings.

Type.—No. 47746, U.S.N.M.

[1] Transferred from Leland Stanford Junior University Museum, where it was numbered 1607.

One specimen, 6¼ inches long, from Clarion Island, of the Revilla-Gigedo group, Mexico. It had been captured by a booby bird, but was still in good condition when taken by us.

Family CENTROPOMIDÆ.

CENTROPOMUS CONSTANTINUS, Jordan and Starks.

Head 2¾; depth 3½; eye 5 in head; snout 3½; interorbital two-thirds eye; dorsal VIII–I, 10; anal III, 7; scales 10–67–13. Posterior half of preorbital rather strongly retrorse-serrate, anterior portion entire; maxillary extending to below the middle of orbit, 2⅓ in head; subopercular flap ending nearly to within 4 scales of the vertical from the origin of dorsal. Gill rakers 4+9. 21 series of scales before first dorsal. Third and fourth dorsal spine equal, about half as long as head; second anal spine longer and much stronger than third, 1⅔ in head, the third longer than the soft rays; ventrals long, 1⅛ in head, nearly reaching vent, their length not quite equal to distance from their tips to anal. Air bladder with very short, blunt, anterior appendages, which are not more than half the length of the pupil. Pectorals 2 in head; caudal short, with roundish lobes, 2 in head. Olive; sides silvery; lateral line dusky; head pale; ventrals pale; tips of dorsal and membrane behind anal spines blackish. Known from 3 specimens collected at Bahia, Brazil, by the *Albatross*.

Type.—No. 43289, U.S.N.M. The description is drawn from a specimen 8¼ inches long, in the Leland Stanford Junior University Museum, No. 1633.

This species appears as new in Jordan and Evermann, "Fishes of North and Middle America."[1]

Family SERRANIDÆ.

EPINEPHELUS NIPHOBLES, Gilbert and Starks, new species.

Head 2⅖ in body; depth 2⅓; dorsal XI–14; anal III, 9; scales 16–116–40; eyes 5 in head; maxillary 2; third dorsal spine 2⅔; middle dorsal rays 2⅛; highest anal rays 2; third anal spine 3$\frac{1}{16}$; pectoral 1⅚; ventrals 1¾; caudal 1⅜.

Form rather robust, moderately compressed; dorsal outline uniformly curved from tip of snout to caudal peduncle; mouth large, the maxillary reaching to below posterior orbital rim; lower jaw strongly projecting; teeth conical and sharp, in one or two bands at sides of jaws, three or four in front; upper jaw with a rather strong canine on each side of front; snout longer than eye; nostrils close together, the posterior one the larger, a little in front of the vertical from front of eye, the anterior in a short, wide tube with a flap behind; vertical and horizontal limbs of preopercle meeting at right angles, its edge with blunt serræ, those at

[1] See Volume I, p. 1125; published October 3, 1896.

angle enlarged; opercle with 3 flat spines before the flap; gill rakers moderate, nearly half eye, 8+16 in number. Top of head, orbitals, maxillary, and mandibles, naked; fine scales on cheeks and opercles; scales on body ctenoid; fins without scales. Dorsal beginning a little in front of the vertical from pectoral base, the third spine a little the highest, but the ones behind it not much shortened; soft dorsal higher than spinous, its outline rounded; pectoral rounded behind, reaching to below the base of eighth dorsal spine; third anal spine the longest, not nearly so long as the soft rays, the anal fin similar in shape to the soft dorsal; ventrals reaching past vent, scarcely to front of anal, their ends rounded, as are all the fins; caudal broadly rounded. Color in spirits brownish red, sides with clear-cut, distinct, white spots about as large as pupil, about 6 at base of dorsal, 6 or 7 along lateral line, following its arch, a horizontal series of 4 extending back from opercular flap, about 3 from base of pectoral following curve of ventral outline, two at base of anal, one behind lower edge of caudal peduncle and one above anus; a well-marked streak above maxillary following its outline; lips colored like rest of head; dorsal dusky, with vague white spots; ventrals and anal nearly black, with a reddish tinge; anal with a narrow white border below; pectoral and caudal uniform yellowish.

Type.—No. 47582, U.S.N.M.

A single specimen, 6 inches in length, collected by the *Albatross* at station 3041, in Magdalena Bay, Lower California.

The species is allied to *Epinephelus niveatus* of the Atlantic.

Family HAEMULIDÆ.

ORTHOPRISTIS FORBESI, Jordan and Starks, new species.

Head $3\frac{1}{3}$; depth 3; dorsal XII or XIII, 15; anal III, II; scales 9–80 to 85–20; snout $2\frac{3}{4}$; maxillary $3\frac{1}{2}$; orbit $4\frac{1}{3}$; longest dorsal spine $2\frac{1}{3}$; second anal spine $3\frac{1}{2}$; pectoral $1\frac{1}{4}$; ventrals $1\frac{2}{3}$; upper caudal lobe $1\frac{1}{4}$.

Body oblong, compressed, the profile gently curved to dorsal. Head moderate, the jaws subequal; teeth small, the outer a little enlarged; maxillary extending to the vertical from posterior nostril; chin with a median pit; interorbital convex, its width about equal to orbit; vertical limb of preopercle slightly convex, finely serrated; gill rakers short, about 8+14=22; preorbital moderate, $3\frac{2}{3}$ in head, 3 in its least width. Snout, maxillary, and lower jaw naked; scales on head small and crowded. Dorsal low, the longest ray about $1\frac{1}{4}$ in the longest spine; second anal spine not longer than third, but slightly stouter, about half as long as the longest ray; pectorals moderate, reaching past tips of ventrals, but not to vent; upper lobe of caudal the longer; second anal spine moderate, about as long as third.

Color (in alcohol).—Dark brown above, with bluish reflections; all fins dusky except pectorals; caudal edged with light, membrane of opercle dark; preopercle with some dark spots.

Type.—No. 47574, U.S.N.M. Named for Dr. Stephen Alfred Forbes, of the University of Illinois, in recognition of his work on the Percidæ.

Two specimens, the type 7½ inches long, from Albemarle Island, one of the Galapagos Archipelago.

Family SCLENIDÆ.

OPHIOSCION STRABO, Gilbert, new species.

(Plate L.)

Closely allied to *O. typicus*, having the same general shape and the elongate caudal which is longer than head. It differs conspicuously in its much smaller eye, its heavier, shorter snout, which barely protrudes beyond the mouth, and its longer, less numerous, preopercular spines.

Snout bluntly rounded, little projecting, the mouth short and broad compared with *O. typicus*. Anterior upper profile very concave, rising rapidly from occiput to dorsal, growing sharply compressed. Mouth moderately oblique, subterminal, the snout protruding beyond the premaxillaries for a distance (measured axially) equaling half diameter of pupil. Maxillary reaching slightly behind front of orbit, $3\frac{1}{6}$ to $3\frac{2}{5}$ in length of head. Mandibular teeth of equal size, in a wide villiform band. Premaxillary band similar, preceded by an outer row of short slender canines. Preorbital rather narrow, half interorbital width. Eyes small, obliquely set, the oblique diameter 4 to $4\frac{1}{2}$ in length of head. Interorbital space transversely convex, its width $3\frac{2}{3}$ in head. A low superciliary ridge. Preopercular margin with a few (4 to 6) slender needle-like spines, the three longer ones wide spaced, evenly radiating about the angle. Margin of lower limb furnished with 5 or 6 minute spinous teeth, compressed triangular, and flexible. Gill rakers short, slender, half diameter of pupil, 6 or 7 above angle, 12 below.

First two and last two dorsal spines rather strong and rigid, the others exceedingly slender and flexible. The third spine is the longest, reaching beyond base of tenth spine when depressed, $1\frac{2}{3}$ to $1\frac{3}{4}$ in length of head. The tenth spine is the shortest, the eleventh longer, representing the first ray of second dorsal. Distance from last dorsal ray to base of middle caudal ray equals length of snout and half of eye. Second anal spine long and slender, half or slightly more than half length of head, three-fourths or four-fifths the longest anal ray. Anal basis but little more oblique than the rest of the abdominal profile. Distance from base of last anal ray to base of middle caudal ray slightly exceeds distance from tip of snout to preopercular margin. Caudal lanceolate, the middle rays much produced, equaling distance from tip of snout to axil of pectorals. Pectorals short, scarcely reaching tips of ventrals, the latter not to vent. Outer ventral ray slightly produced beyond the rest.

Scales smaller than in *O. typicus*, 5 or 6 in the vertical series between lateral line and back. Arch of lateral line ending over the anterior portion of anal fin. Head almost entirely scaled, including mandible,

branchiostegal rays, preorbital, and top of head forward to near extreme tip of snout. On snout, preorbital and mandibles, the scales are cycloid.

Color (*in alcohol*).—Nearly uniform light brown, lighter below and with some silvery luster. Fins all dusky, the anal and ventrals black, the outer ventral ray white. Opercular lining dusky.

Type.—No. 47742, U.S.N.M. Six specimens, the longest, 115 mm. long, from San Juan Lagoon, south of Guaymas, Mexico.

Family CHÆTODONTIDÆ.

HOLACANTHUS IODOCUS,[1] Jordan and Rutter, new species.

Head $3\frac{2}{5}$; depth $1\frac{3}{5}$ (2 in total); eye $4\frac{1}{5}$; dorsal XIV, 20; anal III, 20.

Body very deep, forming almost a regular ellipse, slightly concave above eye and in front of eye. Preorbital, without spine, shorter than width of interorbital, which is narrower than distance between eye and upper end of gill opening. Spine at angle of preopercle straight, longer than orbit, about equal to preorbital; 8 or 9 spines on upper limb of preopercle, these nearly half as long as the one at angle and very much longer than in *Holacanthus ciliaris;* 2 weak spines on lower limb, and 2 on interopercle. Soft dorsal and anal falcate, the longest rays filamentous; pectoral very obliquely rounded, the lower rays scarcely one-third as long as the upper. Ventral slightly filamentous, equal to head. Lateral line regularly arched, but approaching the dorsal outline posteriorly, ceasing before reaching end of dorsal. Scales below lateral line regularly arranged, those above irregular.

Color (*in alcohol*).—Uniform gray (probably orange in life), scales edged with silvery; a very faint, narrow black or dark blue edge to dorsal anterior to filament; terminal half of pectoral, third of caudal, and tips of dorsal and anal behind and including the falcate lobes, yellow; no blue on concave part of dorsal and anal; lips pale, edge of opercle dark blue; a faint indication of a dark blotch in front of dorsal; no blue-black blotch on base of pectoral.

This species differs from *Holacanthus ciliaris* in the elliptical form of the body, in color, and especially in the very long spines on the upper limb of preopercle.

Type.—No. 47747, U.S.N.M. A single specimen, 9 inches long, from the Galapagos Archipelago, collected by United States Fish Commission Steamer *Albatross*.

Family TEUTHIDIDÆ.

XESURUS CLARIONIS, Gilbert and Starks.

(Plate LI.)

Head $3\frac{1}{2}$ in length to base of caudal; depth 2; dorsal VII, 26; anal III, 22; eye 3 in snout; pectoral 4 in length; ventral 7.

[1] *Ἰοδοκος*, a sheaf of arrows, from the spinous preopercle.

Profile undulating, concave on snout and above eyes, produced before eyes and at occiput; occiput forming a well-rounded angle, behind which the curve of the back is uniform to the caudal peduncle. Teeth in a single row, alike in both jaws, wide and flat; outer margin of each tooth oblique, divided into five rounded lobes; lower jaw included; gill opening equal in length to pectoral; first dorsal spine two-thirds as long as the others, which are subequal; ventral spine extending to middle of vent, half length of soft rays; upper rays of pectoral produced, the fin somewhat acute at tip; posterior margin of pectoral concave; anal slightly higher than soft rays of dorsal, but similar in outline. Body, head, and fins everywhere with a villous covering; three large bony plates near tail, but without recurved spines elevated centrally.

Color (*in alcohol*).—Nearly uniform dark olive-brown, sometimes with a few scattered small round black spots; caudal dark yellowish.

Numerous specimens, 15 inches long, obtained by Dr. Gilbert (*Albatross* collection) at Clarion Island of the Revilla-Gigedo group, Mexico.

This species is much deeper than *Xesurus laticlavia* as shown in the figure given by Valenciennes, and is without lateral band.

Family SCORPÆNIDÆ.

SCORPÆNA PANNOSA, Cramer, new species.

(Plate LII.)

Head $2\frac{1}{4}$ ($2\frac{2}{5}$ in total length); depth 3 ($3\frac{3}{4}$ in total length); width at base of pectorals 4; width of head over preopercles $3\frac{3}{4}$; dorsal XII, 10; anal III, 5; pectorals 19. Transverse (oblique) rows of scales 25; lat. l. (tubes) about 25.

Body compressed. Caudal peduncle short, its depth a very little less than orbit. Depth and width of head about equal. Orbit high up, $4\frac{1}{5}$ in head. Interorbital space narrow, 2 in orbit, deeply concave, without prominent ridges. Preocular ridges thick and prominent, with strong spines. Supraocular ridges thin, with blunt spines; postocular spines on rim of orbit, rather sharper; no small spine on rim of orbit behind and external to the postocular; a bifid spine behind middle of posterior rim of orbit, and behind this a thin exoccipital ridge with a blunt spine. A pair of sharp, broadly triangular "coronal" spines with small pits between them and the supraoculars; thin parietal and nuchal ridges of about equal length, with rather blunt spines. Occipital pit of moderate depth, its longitudinal width $1\frac{1}{2}$ in the transverse width, its anterior side sloping backward, its posterior side sloping slightly backward, forming a shallow pocket in posterior part of pit; the pit is continuous on each side between coronal spine and parietal ridge, with a pit behind postero-superior border of orbit. Nasal spines sharp, strong. Preorbital very broad, with moderate ridges, its inferior border lobate, with one small spine directed forward,

another downward. No pit under orbit, but a broad, shallow depression between orbit and suborbital ridge. Suborbital ridge well separated from eye, equidistant from lower rim of orbit and upper edge of maxillary, and composed of three or four minor ridges, each beginning above the one in front of it, and ending under the one behind it; a single small spine at posterior end of last ridge. Uppermost preopercular spine longest, a little below the line of the suborbital ridge; above its base is a small spine nearly in line with the ridge; second, third, and fourth preopercular spines successively smaller, the fifth obsolete. Opercle with two diverging flat ridges with strong spines. Three thin, sharp ridges on shoulder. First two scales of lateral line with bony keels.

Mouth large, nearly horizontal, wholly below inferior rim of orbit. Maxillary reaching about to posterior margin of pupil, $2\frac{1}{4}$ in head; jaws equal, the lower without prominent symphyseal knob; broad bands of teeth on jaws, vomer, and palatines. Pseudobranchiæ large, reaching down nearly to epihyal bone. Gill rakers very short, broad, with many minute spines; about 6 developed, the anterior rudiments tending to form a continuous spinous ridge. Scales moderate, mostly cycloid (or very weakly ctenoid?). Vertex, interorbital space, snout, both jaws, and cheeks above suborbital stay, naked; small embedded scales behind orbits, on cheeks below suborbital stay, on base and flap of opercle. Scales on breast small. Anterior nostrils with broad, leaf-like laciniate flaps; preocular flaps minute, supraocular flaps long, more than half orbit, about one-third as broad as long; numerous flaps on back and sides, on opercle, and edge of preopercle and preorbital; a few small ones on cheeks and on eye above pupil; a large, much-incised and divided flap above base of pectoral parallel with edge of opercular flap, its length about $1\frac{1}{2}$ in orbit. Origin of dorsal opposite upper angle of gill opening; dorsal fin not very deeply notched, the spines only moderately exserted; third and fourth spines equal, about $2\frac{3}{4}$ in head, the following spines decreasing to the eleventh, which is $1\frac{1}{2}$ times as long as the first; longest soft rays about equal to longest spines. Caudal truncate or very slightly rounded, $1\frac{3}{4}$ in head. Second anal spine a little longer than third, about $2\frac{1}{2}$ in head; soft rays a little longer than second spine, not quite reaching base of caudal. Pectorals about $3\frac{3}{16}$ in length of body, reaching nearly to origin of anal; the base procurrent, its width about $3\frac{1}{2}$ in head; rays 19, lower 8 simple, slightly exserted and thickened, the next 10 branched, much longer, the uppermost simple. Ventrals reaching only to vent.

General color apparently scarlet; cheeks under orbits mottled with small, dark, mostly round spots; dorsal and pectoral pale, with slight cloudings and small spots of dark; flaps of sides pale or scarlet, caudal with two faint cross bars of dark spots, faint white spots on the lighter bands; no trace of white spots on posterior part of sides, and no trace of dark band across top of caudal peduncle. Axils pale, with apparently 3 or 4 darker spots. A large dark spot on side behind

opercular flap; two narrow dark bands under posterior half of spinous dorsal, reaching on to abdomen, a broader one under soft dorsal. Peritoneum white.

Type.—No. 47573, U.S.N.M.

Specimen 7½ inches long, from Panama, evidently a shore fish. (The name *pannosus*, tattered, refers to the shoulder flap.)

This species is very closely related to *Scorpæna histrio*, Jenyns, from which it differs in the following points:

Scorpæna pannosa.	*Scorpæna histrio.*
Nineteen pectoral rays, the lower eight simple, the next 10 branched, the uppermost simple.	Twenty pectoral rays, the lower 11 or 12 simple, the next 7 or 8 branched, the uppermost simple.
Occipital pit deeper behind, its posterior wall slanting backward. Its longitudinal width 1⅔ in the transverse width.	Longitudinal width of occipital pit 1⅓ in the transverse width.
Maxillary does not reach posterior border of orbit, 2¼ in head.	Maxillary reaches beyond posterior border of orbit, very slightly more than 2 ($2\frac{1}{10}$) in head.
Ventral fins reaching only to vent.	Ventral fins reaching beyond vent, about one-third of distance from vent to front of anal.
Soft rays of anal not quite reaching base of caudal.	Soft rays of anal reaching base of caudal.
Broad flap above base of pectoral much incised and tattered.	Broad flap above base of pectoral with a nearly continuous edge.
Gill rakers fewer, the rudiments on the front part of the anterior limb apparently forming a continuous spinulous ridge.	
No small spine on rim of orbit behind postocular spine.	A small spine on rim of orbit behind postocular spine.
No trace of white spots on posterior parts of sides or of a small dark bar across back of caudal peduncle.	Several white spots on posterior part of sides, and a small dark bar across back of caudal peduncle.
A distinct large dark spot on side behind opercular flap. Pectorals and soft dorsal with very little dark.	No distinct dark spot on side behind opercular flap. Pectorals and soft dorsal with much dark.
General color in alcohol faded scarlet.	General color in alcohol dark-brown and cherry-red.
Supraocular flap large, more than half orbit.	Supraocular flap small.

In his original description of *Scorpæna histrio* from Galapagos Islands (length, 9 inches), Jenyns gives the following details: Maxillary reaching posterior margin of orbit; small spine on rim of orbit behind postocular spine present only on left side (entirely absent in a smaller

specimen); conspicuous (large) palmated supraocular flaps; eleventh dorsal spine a little longer than the first; 20 pectoral rays, the 10 lower simple, the next 9 branched, the uppermost one simple. His two specimens exactly agree in number of fin rays. The plate accompanying his description (both description and plate based on same specimen) gives the 12 lower pectoral rays simple.

Unfortunately, the writer has had only one specimen of *Scorpæna histrio* from Galapagos Islands and one of *S. pannosa* from Panama for comparison. It would be very desirable to have a series for comparison in order to determine the amount of variation in the color and in the other points in which the two species differ from each other.

SEBASTODES SEMICINCTUS, Gilbert, new species.

(Plate LIII, fig. 1.)

Very closely related to *S. saxicola*, from which it differs conspicuously in its smaller size, its sharply defined cross bars, the smaller head, smaller mouth, and smaller eye, and in the longer and more numerous gill rakers.

Size small, a female with fully developed ova measuring but 130 mm. in total length; our largest specimen, 170 mm. Head $2\frac{9}{10}$ to 3 in length to base of caudal. Body slender, the depth $3\frac{2}{5}$ to $3\frac{3}{5}$ in length. Mandible with a moderate symphyseal knob, which projects to enter the profile. Maxillary scarcely reaching vertical from middle of pupil, $2\frac{2}{5}$ to $2\frac{3}{5}$ in head. Eye averaging smaller than in *S. saxicola*, $3\frac{1}{4}$ to $3\frac{1}{2}$ in head (rarely 3 in head). Interorbital space of moderate width, flat, with a slight median lengthwise groove bounded by a pair of low, rounded ridges, the groove and ridges sometimes not evident. Preocular, supraocular, and occipital ridges low, but sharp and evident, terminating in strong though slender spines. Nasal, preocular, postocular, tympanic, and occipital spines present, the preocular the strongest, directed outward and backward so as to project over the orbit. Parietals not in contact. Preorbital narrow, with two triangular or rounded lobes with or without slight spinous tips. Preopercular spines with compressed triangular base, the upper two usually nearest together, directed backward or slightly upward, the others backward and downward. A subopercular and an interopercular spine closely approximated. Three "humeral" spines. Gill rakers long, slender, very numerous, developed as movable rakers to the extreme anterior end of the arch. Ten or eleven rakers on vertical limb of anterior arch, 27 on horizontal limb, the longest slightly less than half diameter of eye. In *S. saxicola*, the gill rakers number 9 or 10+22 or 23. D. XII, I, 13; A. III, 7.

Fifth dorsal spine highest, $2\frac{1}{4}$ to $2\frac{1}{2}$ in head, longer than the soft rays, the membranes between spines not deeply incised; the notch between dorsals rather shallow, the twelfth spine three fourths to four-fifths length of thirteenth. Caudal emarginate. Second anal spine strong, longer than third, usually not reaching tips of soft rays when

fin is declined; length of second spine half that of head. Ventrals usually reaching to or beyond vent, the pectorals varying from slightly behind vent to slightly behind origin of anal.

Scales on breast cycloid or weakly ctenoid, elsewhere on body rough ctenoid. Head completely scaled, the scales on top of head and on cheeks ctenoid, those on snout, maxillary, mandible, and branchiostegal rays much reduced in size and smooth; 46 to 48 tubes in the lateral line; about 95 vertical transverse series above the lateral line, each series under the dorsal fins containing 7 or 8 scales.

Color (*in alcohol*).—Light brownish above, silvery on lower half of sides and below (tinged with red in life). Snout and top of head dusky; sometimes a dusky streak from tip of snout to eye, a second one crossing between preocular ridges, and a third, less often visible, on occiput. A diamond-shaped brown blotch on the nape and under front of spinous dorsal, extending downward nearly to lateral line. A small blotch under sixth and seventh dorsal spines. A very conspicuous saddle-shaped brown crossbar under the eighth to the eleventh spines; this is wider and lighter next the back, becomes narrower and more intense just above the lateral line, then widens into an intense vertically elliptical blotch on middle of sides. A similar less intense bar under soft dorsal and one on caudal peduncle. The lighter portions of these bars show darker spots and mottlings. Those beneath the fins encroach somewhat on their basal portions. Membranes of dorsal fins with ill-defined roundish spots of light brown. Caudal rays with a few elongate olive-brown spots, some of these often forming a vertical series near base of fin; membranes between the rays largely olive-brown on basal three-fourths of fin. A faint dark spot above middle of base of pectoral. Pectorals, ventrals, and anal white, unmarked. Mouth and gill cavity white; peritoneum brown.

Taken rather abundantly in the Santa Barbara Channel and at first confused with the young of *S. saxicola*, which this species strongly resembles. Specimens before me are from stations 2949 and 2959, in depths of 155 and 55 fathoms.

Type.—No. 47581, U.S.N.M.

SEBASTODES AYRESII, Gilbert and Cramer, new species.

Head $2\frac{2}{5}$; depth $2\frac{1}{3}$; dorsal XIII, 13; anal III, 6; lateral line (pores) 42, 44; transverse rows of scales 43.

Very closely related to *Sebastodes rosaceus*, but the supraorbital ridge lower, thicker, and without spine. Body oblong, not much elevated, its width about 2 in its depth. Orbit large, $3\frac{1}{3}$ in head, snout about $1\frac{1}{4}$ in orbit. Interorbital space concave, 2 in orbit, with a median groove bordered by a pair of ridges diverging backward. Cranial ridges well developed, the preocular, postocular, tympanic, and parietal spines present, sharp. Mouth moderate, jaws about equal, maxillary about $2\frac{1}{3}$ in head, reaching to vertical from posterior border of pupil;

the lower jaw with a small symphyseal knob. Two upper preopercular spines nearly equal, sharp and long, the third shorter and broad; lower opercular spine horizontal, the upper larger and directed somewhat upward. Gill rakers moderate, the longest about 3 in orbit, 21 on horizontal limb of first arch. Scales moderate, ctenoid; accessory scales numerous; mandible naked. Interorbital space, preorbitals, maxillaries, the rays of the dorsal, anal, and caudal fins, and the median rays of the pectorals, scaly. Fourth dorsal ray longest, about $2\frac{1}{3}$ in head, the twelfth about $2\frac{1}{2}$ in the fourth; the dorsal rays shorter than the longest spines. Second anal spine much longer and stronger than third, about 2 in head; the rays equal to the second spine. Caudal slightly emarginate. Pectorals moderate, reaching a little beyond vent, the median rays longest, $3\frac{1}{2}$ in length of body; base of fin a little less than orbit; the 7 lower rays simple, somewhat thickened. Ventral fin reaching vent.

Color (in alcohol).—Like *Sebastodes rosaceus:* dark brownish above, paler below. A small pale, pinkish spot immediately under base of fourth dorsal spine, and another small one immediately under base of eighth spine; a third larger spot just above lateral line and under the ninth spine; a fourth spot immediately under the first, and a fifth under the last dorsal rays. Peritoneum dark brown, speckled with black dots.

Type.—No. 47744, U.S.N.M.

Taken on a trawl line at Cortez Banks, near San Diego; collected by the *Albatross.* Length, 9 inches.

Distinguished from *Sebastodes rosaceus* especially by the absence of the supraocular spine.

SEBASTODES CRAMERI, Jordan, new species.

Head $2\frac{2}{3}$; depth $2\frac{4}{5}$; dorsal XIII, 14; anal III, 7; lateral line (pores) 48 (+1 on caudal); transverse rows of scales, 49.

Body compressed, its thickness $2\frac{1}{4}$ in its depth. Interorbital space flat, $4\frac{1}{2}$ in head; cranial ridges low but evident, the parietal ridges thin. Preocular, supraocular, postocular, tympanic, parietal, and nuchal spines present, the last-named spines being marked off from the parietal ridges only by depressions, and the parietal spines not well marked. Orbit nearly circular, $3\frac{1}{5}$ in head. Snout about equal to interorbital width; preorbital with two triangular lobes, but no distinct spines. Maxillary reaching a little beyond vertical from middle of eye, $2\frac{1}{4}$ in head. Mandible scarcely projecting, with a small, symphyseal knob. The three upper preopercular spines nearly equal, a little divergent, the lowest one obsolescent. Opercular spines moderate, nearly equal. Gill rakers slender, $2\frac{1}{3}$ in orbit, 21 on horizontal limb of first arch. Scales of medium size, those on opercles and cheeks ctenoid, those on snout, preorbital, maxillary and mandible scarcely ctenoid; accessory scales in moderate number. Dorsal spines rather low, the fourth longest, $2\frac{2}{3}$ in head, the twelfth about half as long; the membrane of spinous

dorsal rather deeply incised; longest dorsal rays about equal to longest spines. Second anal spine about equal to the third, but stronger, curved, 3 in head, about $1\frac{1}{4}$ in soft rays. Caudal emarginate. Base of pectoral $2\frac{2}{3}$ in head, the 10 lower rays simple, the middle rays longest, $3\frac{2}{5}$ in length of body, and reaching a little beyond origin of anal; ventrals reaching a little beyond vent.

Color (in alcohol).—Yellowish, darker above (doubtless bright red in life); 4 short, faint cross bands on upper part of sides, one under second, third, and fourth dorsal spines, a second under sixth and seventh spines, a third under ninth, tenth, and eleventh spines, and the fourth under the soft dorsal; a black spot on upper part of opercle; membrane of spinous dorsal, black-edged. Dorsals and pectorals a little dusky, fins otherwise pale. Inside of mouth a little dusky at the sides and in front of tongue; lining of gill cavities dusky in front of pseudobranchiæ. Peritoneum, dark brown.

Type.—No. 47745, U.S.N.M.

A single specimen, taken by the *Albatross* at station 3091, 87 fathoms, off Tillamook, Oregon.

It is named for Mr. Frank Cramer, of Leland Stanford Junior University, in recognition of his work on the genus *Sebastodes*.

Family TRIGLIDÆ.

PRIONOTUS LOXIAS, Jordan, new species.

Head $2\frac{1}{2}$; depth $3\frac{1}{2}$; dorsal X–10 or 11; anal 10; scales about 50.

Body stout; head large, rough; mouth moderate, maxillary not reaching front of orbit, $2\frac{2}{3}$ in head; eye large, $3\frac{3}{4}$ to 4 in head; snout $2\frac{1}{2}$ in head; opercular spine strong, nearly as large as preopercular spine; humeral spine small, not half as large as either of the others; interorbital area narrow, concave, its width $2\frac{2}{3}$ in eye; preopercular spine without smaller one in front; no spine at center of radiation of cheek; preorbital edge prominent, finely denticulated; supraorbital ridge prominent, with a bluntish spine before and behind; a transverse groove on head behind eye; snout broad, slightly emarginate at tip, the rostral plates not much projecting, their edges sharply and finally serrate, with 10 to 12 serræ; occipital ridges a short distance behind supraorbital ones, ending each in a bluntish spine, as do also the nuchal ridges. Teeth on jaws, vomer, and palatines in bands; lower jaw included; base of mandible below front of orbit. Bones on cheeks and opercles with strong striæ, the rest of the bones of the head roughish. Gill rakers short, about 10 below the angle, the anterior ones tubercle-like; breast closely scaled. Pectorals short, $3\frac{1}{4}$ to $3\frac{1}{2}$ in the length of body, scarcely longer than longest detached ray, their tips reaching about third ray of anal fin, their length $3\frac{1}{2}$ in the body; ventrals long, their tips almost reaching tips of pectorals, $1\frac{2}{3}$ in head; first dorsal spine the longest, its length $1\frac{4}{5}$ in head, serrate in front; first dorsal ray slightly serrulate at

base, its length 3 in head; longest anal ray 4 in head; caudal fin lunate, with pointed lobes, $1\frac{3}{4}$ in head.

Color.—Brownish above, grayish below; head and anterior parts more or less distinctly vermiculated with dark olivaceous, these markings especially distinct on bones of head; sides with 6 to 15 narrow brown oblique bands extending downward and backward from the lateral line about halfway to anal fin, these obsolete or less conspicuous on anterior portion of the body; both dorsals mottled with olive; caudal with 3 broad, blackish bars which do not cross the upper and lower ray, the last bar broad and very conspicuous; upper ray of caudal dark olive; no black spot at base of caudal; anal and ventrals white; pectorals blackish, faintly barred with darker and margined with white.

Here described from many specimens, 3 to 6 inches long, from station 2805, Bay of Panama, $51\frac{1}{2}$ fathoms, where it occurs with *Prionotus xenisma*, but more abundantly than the latter. It has not yet been seen elsewhere.

Type.—No. 47580, U.S.N.M.

Family URANOSCOPIDÆ.

ASTROSCOPUS ZEPHYREUS, Gilbert and Starks, new species.

(Plate LIII, fig. 2; also Plate LIV.)

Head $2\frac{2}{3}$; depth $3\frac{2}{5}$; dorsal V-13; anal 14; scales 84; eye 12 in head; maxillary $2\frac{1}{3}$; pectoral $1\frac{1}{4}$; second dorsal spine 7; highest dorsal ray $2\frac{1}{3}$; highest anal ray $3\frac{1}{6}$; caudal $1\frac{3}{4}$.

Body robust, widest at occiput, slightly compressed posteriorly, anteriorly subcylindrical. Head very large and broad, wider than the body; mouth large, vertical, a fringe of barbels curving over mouth on each jaw, their length a little greater than the diameter of the eye; tongue very large and fleshy, forming a pad under the membrane of lower jaw, which projects forward somewhat; teeth conical, small and movable, in many bands in upper jaw: in lower jaw the teeth are larger and in two or three rows; vomer and palatines with teeth. Eyes very small but prominent; interorbital very wide, four times as wide as the eye; bones on top of head coarsely granular; Y-shaped ridge on top of head conspicuous, with a broad naked area on each side; the form of these and other bones of the head exactly as in *A. y-græcum;* edges of nostrils closely fringed; anterior nostril round, the ridge between it and eye not very high or conspicuous; posterior nostril ending in a long curved furrow which runs obliquely across the naked area behind eyes; at its posterior end it turns sharply forward, its length $2\frac{2}{3}$ times the diameter of the eye; two very short blunt spines in front of eye; surface of the opercle, preopercle, and humeral process granular, not so rough as in *A. y-græcum;* gill rakers not developed; pseudobranchiæ very small.

Head entirely scaleless; belly naked below a line drawn from first anal ray to the middle of pectoral base; fins without scales; scales small and nearly square, grown together side by side, forming oblique series.

Width of pectoral at base slightly less than half length of head; the fin is pointed and slightly turned up, its tip reaching to the vertical from base of the third dorsal ray; the ventral rays are thick and swollen, the inner rays the longest, the fin reaching almost midway between its base and tips of pectorals; insertion of ventrals in front of pectorals a distance equal to the width of pectoral base; soft dorsal somewhat higher than anal, its posterior rays reaching to the vertical from base of last anal ray; tip of last anal ray nearly reaching to the base of caudal rays; caudal truncate or slightly rounded; a fold of skin along middle line of belly from ventrals to vent.

Color.—Dark brown above, paler below; upper parts with many round white spots of various sizes, edged with rings of dark brown; spinous dorsal black, light posteriorly; soft dorsal light at base, the ends of the rays with black and white stripes; pectorals and anal dusky with light edge, caudal with longitudinal black and white stripes.

Type.—No. 47743, U.S.N.M.

A single specimen, 12 inches in length, collected by the *Albatross*, in Magdalena Bay, Lower California.

A distinct electric shock was given by this fish when alive, the electric organs being apparently located in the fleshy areas on top of head behind the eyes.

Family BLENNIIDÆ.

EMMNION,[1] new genus.

EMMNION BRISTOLÆ, Jordan, new species.

(Plate LV, fig. 1).

Head $5\frac{2}{7}$; depth $7\frac{1}{2}$; dorsal XXV, 13; anal I, 27; pectoral 13; ventral I, 3; Branchiostegals 5; scales 3–63–11, the count not certain.

Body slender, moderately compressed; the dorsal profile forming a nearly straight line from occiput to first dorsal ray, from thence descending very gently to base of caudal; ventral profile about straight. Head broad, slightly convex above, its width $1\frac{1}{2}$ in its length. Anterior profile from first dorsal spine to a point above eye straight, thence abruptly descending to tip of snout. Mouth horizontal, the lower jaw included. Maxillary reaching nearly to posterior margin of eye, about $2\frac{1}{2}$ in head. Teeth present on both jaws, canine-like; upper jaw with 8 enlarged teeth in front, about 2 or 3 series of much smaller teeth behind these, only 1 series of which extends into posterior region of mouth; lower jaw with a series of teeth in front and on sides which become greatly enlarged in front; a patch of very small teeth behind the enlarged

[1] *Ἐν*, in; *μνίον*, sea moss, or alga.

front teeth. No teeth on vomer or palatines. Premaxillaries very protractile. Snout blunt, $4\frac{1}{6}$ in head. Eyes large, round, placed close together, $3\frac{1}{4}$ in head. Interorbital region very narrow, less than pupil. Nostrils equal. Caudal peduncle $2\frac{1}{3}$ in head. Branchiostegal membranes deeply united, free from isthmus. Gills 4, a small slit behind the fourth. No cirri above eyes, nor filaments on nape. Head naked; body covered with cycloid scales, those on nape much smaller; belly naked.

The scales on the body are apparently caducous, as all have fallen, but the impressions are very distinct; they seem to have been embedded on their anterior edge, as the sac-like fold of skin is prominent. Lateral line simple, straight, running from upper edge of gill opening to last ray of dorsal when it disappears, not reaching the caudal. It is placed very high, and gradually approaches the dorsal fin, from which it is separated only by a very small distance. Dorsal extending from a point a short distance behind occiput nearly to base of caudal; the fin is emarginate, with the last spine shortest, about $2\frac{1}{4}$ in first soft ray, the latter $2\frac{1}{7}$ in head; longest dorsal spines about 3 in head, all the spines slender and flexible. Anal extending from behind vent nearly to base of caudal; similar to soft dorsal, its rays lower. Ventrals well developed, inserted very slightly in front of base of pectorals, with broad base, the rays thickish. Length of ventrals $1\frac{1}{3}$ in head, the fin reaching three-fifths the distance to vent. Caudal subtruncate. Pectorals reaching past vent, about as long as head. Dorsal and anal free from caudal.

Color (*in alcohol*).—Dark reddish brown, lighter below; head very dark. Dorsals, pectorals and caudal blackish, pectorals and caudal with lighter blotches; anal and ventrals dusky, anal margined with darker. Length about 3 inches. Here described from a specimen taken by the *Albatross* from Galapagos Islands.

Type.—No. 47578, U.S.N.M.

It is evidently a rock-pool species. The species is named for Miss Susan Brown Bristol, of the department of zoology in Stanford University, in recognition of her work on fishes. It is the type of a distinct genus (*Emmnion*), remotely allied to *Labrosomus* and *Pseudoblennius*, distinguished especially by its straight dorsal lateral line ending at base of last dorsal ray, by its scaly body, and by its dentition. Its relations to any other American genus are not intimate.

Family XIPHIDIONTIDÆ.

ULVICOLA, new genus.

ULVICOLA SANCTÆ-ROSÆ, Gilbert and Starks, new species.

(Plate LV, fig. 2.)

Head 10 in body; depth 13; dorsal XCVII; anal I–40; eye $4\frac{1}{2}$ in head; caudal $1\frac{1}{2}$.

Body elongate as in *Xererpes*, strongly compressed, upper profile of head slightly convex, no constriction at nape; mouth very small, oblique, the maxillary reaching about to front of eye; teeth very small, in a single row on jaws; vomer with teeth; interorbital a narrow sharp ridge; snout about equal to length of eye; gill opening short, limited to the part below angle of opercle, adnate above to shoulder girdle. Origin of dorsal above upper end of gill opening, much nearer occiput than tip of snout; anal spine small, not channeled as in *Xererpes fucorum;* origin of anal nearer base of caudal than tip of snout by a distance equal to twice length of head; pectorals and ventrals obsolete; caudal rather long, confluent with dorsal and anal.

Color (in alcohol).—Light brown, slightly lighter under head and on belly; no markings.

Type.—No. 47579, U.S.N.M.

Specimen 4½ inches in length; collected by the *Albatross* in a rock pool at Santa Rosa Island, California, January 6, 1889.

The new genus *Ulvicola* is allied to *Xererpes.*

Family BLENNIIDÆ.

EMBLEMARIA OCULOCIRRIS, Jordan, new species.

Head 3¾; depth 6⅔; dorsal about 35; anal 25.

Upper part of eyeball with a slender cirrus tipped with black, this nearly as long as eye; eye longer than snout, about 3¾ in head, the maxillary extending to below posterior part of pupil; snout sharper than in *Emblemaria nivipes*, two-thirds eye; teeth small, rather sharp, directed backward; longest dorsal spine as long as head; pectorals 1⅓ in head; ventrals 1⅔, inserted before pectorals.

Color (in alcohol).—Brown, with traces of about 9 blackish cross bars, which are separated on the back by whitish quadrate interspaces; a white spot at nape; some dusky below eye; dorsal dusky, the pale bars of back extending on its base; anal dusky; ventrals blackish; caudal pale, its tip black; pectorals pale.

Type.—No. 47749, U.S.N.M.

Specimen 1½ inches long; collected by the *Albatross*, La Paz, California. It seems to be very close to *Emblemaria nivipes.*

Family GADIDÆ.

LEPIDION VERECUNDUM, Jordan and Cramer, new species.

Head 3⅓; depth 4¼; dorsal VIII-40; anal 37; ventral apparently 4 (some rays broken on each side); scales about 75, not to be exactly counted.

Body robust, compressed, tapering from the large head to the very slender, attenuate tail, which is not so broad as pupil. Head large, not greatly compressed, not keeled above, its sides scaly; lower jaw

with some scales; interorbital space depressed, 5¾ in head. Eye very large (in young), 2⅔ in head; snout short, depressed, not pointed, and with lateral keel, 5¾ in head. Preorbital very narrow. Mouth rather large, oblique, the maxillary reaching to below front of pupil, 2⅔ in head; lower jaw slightly longer, its tip with a stiffish pointed projection representing the barbel; teeth small, in bands, a few on vomer. No spines on snout or opercles. Gill membranes somewhat united, free from isthmus. Gill rakers slender, rather long, 10 to 12 on lower part of arch. Scales very small, mostly lost posteriorly and not to be exactly counted. Lateral line not evident. First dorsal rather low and long, none of its rays produced, the longest about half head. Ventrals filamentous, half head; pectorals about half head; caudal 2½ head; anal deeply notched behind the middle, its posterior lobe highest.

Color uniform purplish black, the fins paler.

Type.—No. 47748, U.S.N.M.

Young specimen, 2¼ inches long, from *Albatross* station 2993, in 364 fathoms, near Clarion Island of the Revilla-Gigedo group, Mexico.

Family PLEURONECTIDÆ.

PARALICHTHYS WOOLMANI, Jordan and Williams, new species.

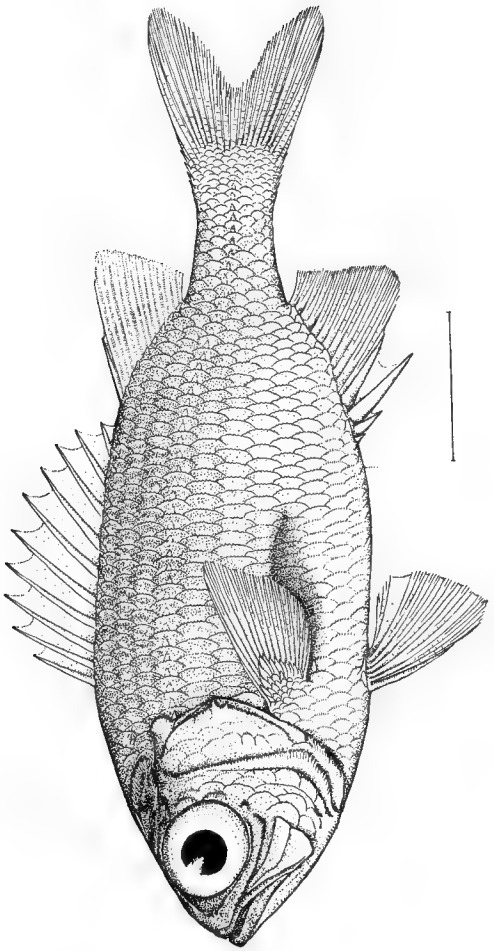
Head 3½; depth about 2 in length of body; gill rakers 5+11; dorsal 74; anal 57; pectoral 12; ventral 6.

Flesh firm. Body oblong; mouth large, mandible heavy, not projecting; about 8 teeth on each side of lower jaw, the anterior ones long but slender; teeth in upper jaw smaller than those in lower jaw; the lateral teeth very small and close set. Eye small, 5½ in length of head; interorbital area moderately prominent, narrow, about two-fifths in length of eye. Scales cycloid, small anteriorly and increasing in size posteriorly, covering head and fins; about 100 on lateral line. Lateral line greatly arched anteriorly, the arch about 3½ times in length of straight portion. Gill rakers slender, the longest about one-half length of eye. Pectoral and ventral fins small; pectoral about one-half length of head. Origin of dorsal opposite anterior margin of eye; caudal ending in an obtuse angle, not double concave; caudal peduncle wide. Anal spine obsolete. Body and fins blotched with deep brown and pearly white and speckled with very dark brown, blotches more definite on median fins and especially on caudal where there are three indefinite lines of blotches crossing the skin.

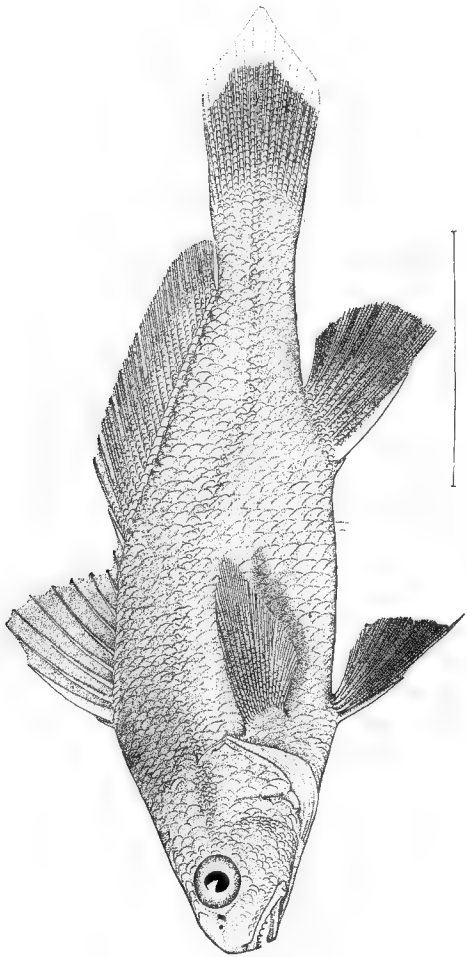
Type.—No. 47575, U.S.N.M.

Specimen 9½ inches long, taken at the Galapagos Islands by the *Albatross* in 1888. It was then thought to be *Paralichthys adspersus*, from which species it differs but little except in the number and length of the gill rakers.

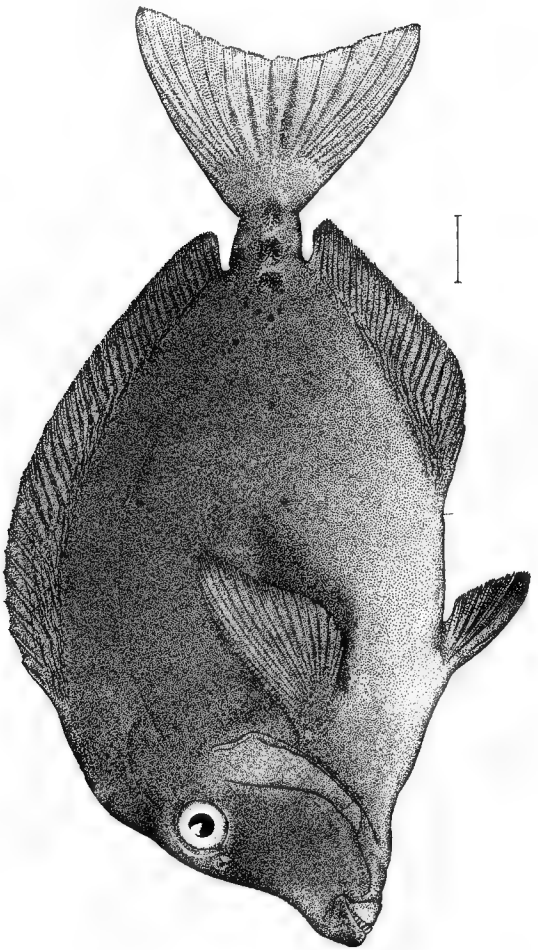
This species is named for Mr. Albert J. Woolman, of Duluth, Minnesota, in recognition of his work on the fresh-water fishes of Mexico and Florida.



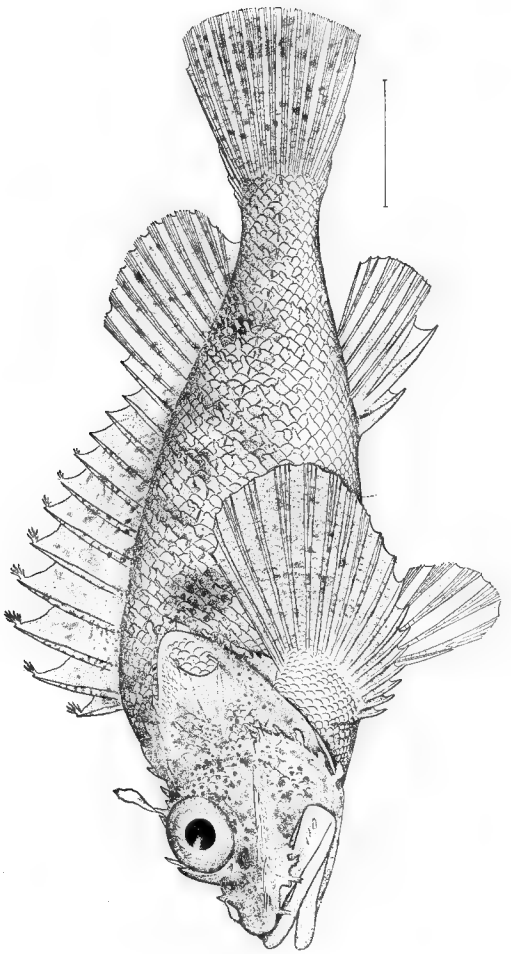
MYRIPRISTIS CLARIONENSIS.



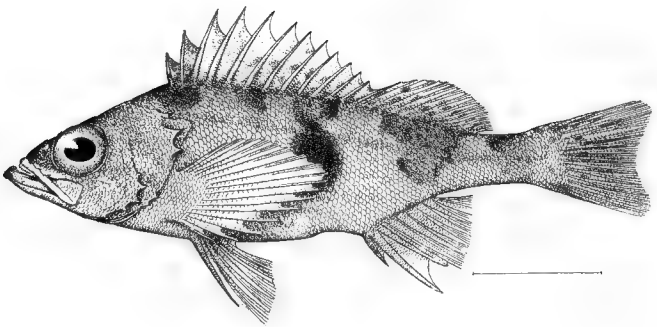
OPHIOSCION STRABO.



XESURUS CLARIONIS.



SCORPÆNA PANNOSA.



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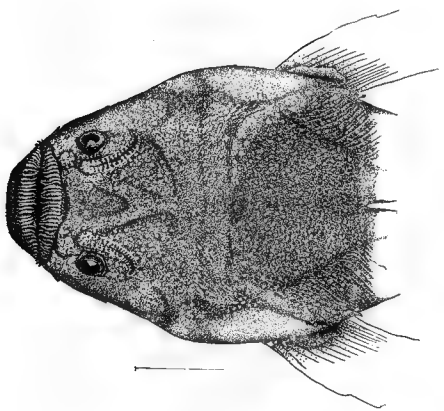
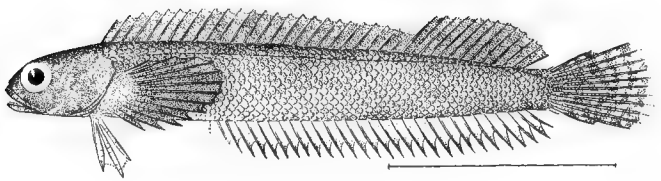


2

NEW FISHES FROM THE PACIFIC OCEAN.

FIG. 1. *Sebastodes semicinctus.*
FIG. 2. *Astroscopus zephyreus.*

ASTROSCOPUS ZEPHYREUS.



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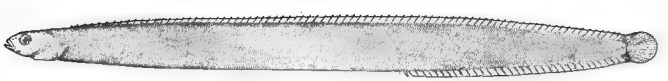


2

NEW FISHES FROM THE PACIFIC OCEAN.

FIG. 1. *Emmion bristolæ.*
FIG. 2. *Ulvicola sanctæ-rosæ.*

BIRDS OF THE GALAPAGOS ARCHIPELAGO.

By ROBERT RIDGWAY,
Curator of the Department of Birds.

Introduction.—While the present publication is intended to embody practically all that is known of the avifauna of the Galapagos Archipelago, it does not claim to be exhaustive, for a great deal has yet to be learned before anything like a complete exposition of the subject is possible. Although our knowledge of the bird life of this interesting island group has been vastly increased since the publication of Darwin's discoveries there, chiefly through the large collections made by Dr. Habel in 1868, the naturalists of the *Albatross* in 1888 and 1891, and Messrs. Baur and Adams in 1891, the information which has accumulated is still too fragmentary to warrant any serious attempt to solve the problems to which Mr. Darwin first called attention.

Theories as to the origin of the Galapagoan fauna and related problems will therefore be briefly touched in the following pages, the principal object of the work being to collate the knowledge thus far secured and thereby facilitate future investigation in the field whose natural products afforded the basis of Darwin's deductions concerning "the complicated problems involved in the doctrine of the derivative origin of species, the importance of which in their bearing upon the study of natural science has never been equaled."[1]

But for the unfortunate loss in transit of a box containing a large number of specimens collected by Messrs. Baur and Adams on South Albemarle, Charles, Hood, and Barrington islands,[2] we should know much more concerning the fauna of those islands from which such scant material has been examined by naturalists.

Not a single island of the group can be said to have been exhaustively explored,[3] and few of the species are known in all their various

[1] Salvin, Trans. Zool. Soc. Lond., IX, Pt. IX, 1876, pp. 461–462.

[2] This box, which was lost or stolen at Guayaquil, contained specimens of land birds from these least explored islands of the group, among them being more than forty species from the southern part of Albemarle Island, the fauna of which is almost unknown.

[3] Many novelties may be expected to occur in the elevated interior portions of the islands, where "clouds usually hang over the higher mountains, where the moisture is far greater than on the seashore, and consequently the vegetation is far more luxuriant" (Salvin). These verdurous mountain districts, being less readily accessible than the arid lowlands, are doubtless but very imperfectly explored.

phases; in fact, many are known only from a few specimens in female or immature dress. No observations have been made "upon the attitude the different species of *Geospiza*[1] maintain toward one another tending to show how far the differences observable, or thought to be observable, in dried specimens indicate the actual grouping in species of living individuals."[2] The anomaly of individuals adult as to plumage but with bills suggesting immaturity, and of others which show exactly the reverse, remains to be explained; and there are other questions which only protracted field-studies by a competent investigator can decide. Until all these present mysteries are solved, theories and generalizations are necessarily futile.

An effort to obtain the unknown data should not be too long delayed. As Mr. Salvin truly says:[3]

> The advent of man to islands previously uninhabited is of the highest importance to the existence of the indigenous fauna and flora. It may safely be said that these islands have been visited from time to time for more than three centuries, so that during this period man's influence has been more or less felt by the indigenous products. This influence is manifested in all similar cases by the capture and destruction for food of all animals fit to eat; and in order to establish a supply of fresh food for vessels in need of it, pigs and goats are usually turned out in such places. The vegetation chiefly suffers from the latter, while upon such animals as easily fall a prey to the former the effect is generally very speedily marked. Cats often abound on such islands, and rats and mice escaped from some vessel calling for wood and water. All these prove enemies to some previously unmolested species. Fires, too, either wantonly or carelessly lighted, sometimes work great destruction.
>
> So far as the birds of the Galapagos Islands are concerned the effect produced by the visits of ships, chiefly whalers, and the attempts at colonization do not seem to have lessened their numbers at present. Judging from the records of the various authors I have been able to consult, I should say that birds are about as numerous now as they were two centuries ago. How long this will remain so is uncertain. All the species are able to fly, and thus protect themselves from the wild pigs and cats, their most open enemies. The effect upon the vegetation produced by the cattle, horses, and goats may eventually lessen the number of birds, if not eradicate some of the species; but as so many of the species resort to the seashore for food, the destruction of the vegetation will be of less importance than it otherwise might. With a lessened vegetation, however, less rain would fall, and in consequence the increased difficulty in procuring water will operate against the birds maintaining their numbers. On the whole, it seems evident that the avifauna of these singular islands is menaced not only by open enemies, but also is in danger of serious injury should any further disturbances of the conditions of life supervene.

Since the preceding paragraphs were published it has been ascertained that at least one of the indigenous birds of the Galapagos has apparently become extinct, the larger mockingbird of Charles Island (*Nesomimus trifasciatus*) having been fruitlessly searched for by the naturalists of the *Albatross* and by Messrs. Baur and Adams. Others appear to have become extinct on the islands where they were origi-

[1] Also those of *Camarhynchus*, of which also there are sometimes several forms found on a single island.

[2] Salvin, Trans. Zool. Soc. Lond., IX, Pt. IX, 1876, p. 469.

[3] Ibid. p. 455.

nally found; as the largest of the ground finches (*Geospiza magnirostris*), which seems no longer to inhabit Charles or Chatham islands, where Darwin collected his specimens,[1] and *Camarhynchus variegatus*, originally discovered on Abingdon and Bindloe islands, but according to Dr. Baur no longer occuring there.[2]

It is evident, therefore, that if we are to acquire a more exact knowledge of this classic fauna, an effort to do so should be made before it is too late.

I have already remarked that the time has not arrived when we may indulge in speculations as to the origin of the Galapagoan fauna with reason for great confidence in the correctness of any theories which may be advanced. Nevertheless, a few observations on the subject with reference to Dr. Baur's subsidence theory[3] as opposed to that of volcanic uplift, together with the possibility of a non-American element in the composition of the fauna, may not be altogether futile.

All writers are agreed that the Galapagos Islands are volcanic; nearly all, from Darwin to Agassiz, agree that they were uplifted from the sea by volcanic action, and that their upheaval therefore antedates the advent of organic life upon them. Dr. Baur, however, believes that these islands are the higher points of an extensive submerged area, whose subsidence took place after a fauna and flora had been acquired; or, to quote his own words: "At a former period these islands were connected with each other, forming a single large island, which itself at a still earlier time was united to the continent, probably with Central America and the West Indies."[4]

I am not competent to discuss the relative merits of these two opposite theories from the physiographer's standpoint; but if the apparent relationships of the fauna have any bearing on the question, I believe Dr. Baur's theory to be at least worthy of serious consideration.

By reference to the map accompanying Professor Agassiz's report upon the *Albatross* cruise of 1891,[5] it will be seen that the Galapagos Archipelago and Cocos Island rise from a submarine plateau of 1,500 fathoms depression, which at its northeastern extremity approaches within 100 miles of the nearest point of the present coast line of Central America, being separated from the 1,500-fathom coast line by only

[1] Dr. Baur says (Amer. Nat., XXV, 1891, p. 905) that he and Mr. Adams collected this species on South Albemarle and Jervis islands; but their specimens were lost, and it is possible that the birds they met with were not the true *G. magnirostris*, but an undescribed related form.

[2] It has subsequently been ascertained to inhabit Albemarle, James, Indefatigable, Chatham, and Charles islands. The question therefore arises, Has it shifted its range from Abingdon and Bindloe to these islands, or were the original specimens wrongly labeled as to locality?

[3] Amer. Nat., XXV, 1891, pp. 217–229, 307–326.

[4] The Differentiation of Species on the Galapagos Islands and the Origin of the Group. Biological Lectures delivered at the Marine Biological Laboratory of Woods Hole, in the summer session of 1894. Reprint, pp. 67–78.

[5] Bull. Mus. Comp. Zool., XXIII, No. 1, pl. III.

a little more than 30 miles of deeper water, and this of less than 2,000 fathoms depth. Its eastern edge, on the other hand, is decidedly more than 200 miles distant from the nearest point on the coast of Ecuador (a little south of the equator), while the deeper water between is more than five times as wide as the northeastern "strait."

If Dr. Baur's theory be correct, therefore, the Galapagos group and Cocos Island were once culminating points of his "single large island," and the nearest approach of this oceanic land area to the continental area was toward the southern portion of Central America.[1] It is somewhat in favor of Dr. Baur's theory that at least one of the smaller land birds of the Galapagos (*Dendroica aureola*) is common also to Cocos Island; but as the same species is said to occur also along the coast of the mainland, from Gorgona Island to the Gulf of Guayaquil, its bearing on the subject loses some of its importance. We unfortunately know very little as to the birds of Cocos Island, only four species of land birds having thus far been collected there.[2] Of the three remaining Cocos Island birds, one (*Coccyzus ferrugineus*, Gould) is most nearly related to a Central American and West Indian species, *C. minor*, (Gmelin). The other two—*Cocornis agassizi*, Townsend,[3] and *Nesotriccus ridgwayi*, Townsend[4]—are genera peculiar to Cocos Island, whose

[1] That portion of the Colombian isthmus between the southern boundary of Costa Rica and the Bay of Panama.

[2] Cocos Island lies within the rain belt and supports an exceedingly luxuriant vegetation from its summit down to the water's edge, numerous streams dashing down its mountain sides into the sea. Undoubtedly it supports a much more varied bird fauna than any of the Galapagos Islands, and interesting if not remarkable forms remain to be discovered there. Unfortunately it is difficult of exploration on account of the density of the vegetation, which can only be penetrated by the aid of a machéte; but as Mr. Townsend, who made a brief landing there February 28, 1891, collected among four species of land birds two new and exceedingly distinct genera, it is to be hoped that the unknown treasures which certainly await discovery may tempt some adventurous naturalist to direct his efforts to a thorough exploration of this island.

Mr. Townsend has recently published a list of the birds which he obtained on Cocos Island, in a paper with the following title:

Bulletin of the Museum of Comparative Zoology | at Harvard College. | XXVII, No. 3. | —— | Reports on the Dredging operations off the West coast of | Central America to the Galapagos, to the West coast | of Mexico, and in the Gulf of California, in charge of | Alexander Agassiz, carried on by the U. S. Fish Commis | sion steamer *Albatross*, during 1891, Lieut. Commander | Z. L. Tanner, U. S. N., commanding. | XVII. | Birds from Cocos and Malpelo Islands, with notes on | Petrels obtained at Sea. | By C. H. Townsend | [Published by Permission of Marshall McDonald, U. S. Fish Commissioner.] | With Two Colored Plates. | Cambridge, Mass., U. S. A.: | Printed for the Museum. | July, 1895.

Pages 121-126; plates not numbered.

[3] *Cocornis*, TOWNSEND, Bull. Mus. Comp. Zool., XXVII, July, 1895, p. 123. Type, *C. agassizi*, Townsend (Bull. Mus. Comp. Zool., XXVII, July, 1895. p. 123, colored plate; Cocos Island; U. S. Nat. Mus.).

[4] *Nesotriccus*, TOWNSEND, Bull. Mus. Comp. Zool., XXVII, July, 1895, p. 124. Type, *N. ridgwayi*, Townsend (Bull. Mus. Comp. Zool., XXVII, July, 1895, p. 124, colored plate; Cocos Island; U. S. Nat. Mus.).

nearest relatives, apparently, are the Galapagos genus *Geospiza* (subgenus "*Cactornis*") and subgenus *Eribates* of the continental genus *Myiarchus*. If, therefore, the Galapagos group and Cocos Island, together with a connecting land area, were formerly united to the continent, the relationships of their bird fauna point to a Central American rather than a South American connection; but in order to account for this relationship actual land connection with the continent is not necessary, the narrow passage of deep water (between 1,600 and 1,700 fathoms) which possibly may always have intervened being easily crossed by birds of only ordinary powers of flight.

Forty-six genera of birds have thus far been found in the Galapagos Archipelago. Following is a list of them, together with an exposition of their geographic range:

List of genera of Galapagos birds.

Names of genera.	Geographic range.							
	Peculiar.	Antarctic.	Pacific.	South American.	Central American.	West Indian.	North American.	Cosmopolitan or Tropicopolitan.
1. Nesomimus	x				x	x	x	
2. Dendroica								x
3. Certhidea	x							
4. Progne				x	x	x	x	
5. Geospiza	x							
6. Camarhynchus	x							
7. Dolichonyx							x	
8. Myiarchus				x	x	x	x	
9. Pyrocephalus				x	x			
10. Coccyzus				x	x	x	x	
11. Strix								x
12. Asio								x
13. Buteo								x
14. Fregata								x
15. Pelecanus								x
16. Sula								x
17. Phaëthon								x
18. Ardea								x
19. Herodias								x
20. Butorides								x
21. Nyctanassa				x	x	x	x	
22. Phœnicopterus								x
23. Pœcilonetta				x		x		
24. Querquedula								x
25. Nesopelia	x							
26. Porzana								x
27. Gallinula								x
28. Hæmatopus								x
29. Arenaria								x
30. Squatarola								x
31. Ægialitis								x
32. Calidris								x
33. Tringa								x
34. Heteractitis			x					
35. Numenius								x
36. Himantopus								x
37. Larus								x
38. Creagrus	x?							
39. Anous								x
40. Diomedea								x
41. Aestrelata								x
42. Puffinus								x
43. Oceanodroma								x
44. Procellaria								x
45. Oceanites								x
46. Sphenisous		x						
Summary	6?	1	1	6	6	6	6	30

SUMMARY.

Groups of genera.	Number of genera.	Per cent of whole number.
Peculiar genera	6?	13.04
Antarctic genera	1	2.17
Pacific genera	1	2.17
Genera peculiar to North America	1	2.17
Genera of wide or general range	30	65.22
Genera common to Central America, West Indies, and North America	1	2.17
Genera common to South America, Central America, West Indies, and North America	4	8.70
Genera common to Central America and South America	1	2.17
Genera common to South America and West Indies	1	2.17
Total	46	.....

Taking into consideration, however, only those genera which have species breeding (or presumably breeding) in the Galapagos Archipelago (whether peculiar or not), the result is slightly different, as the following will show:

Groups of genera.	Number of genera.	Per cent of whole number breeding.
Peculiar genera	6	15.8
Antarctic genera	1	2.6
Pacific genera	1?	2.6
Genera common to Central America, West Indies, and North America	1	2.6
Genera common to South America, Central America, West Indies, and North America	4	10.5
Genera common to Central America and South America	1	2.6
Genera common to South America and the West Indies	1	2.6
Genera of wide range	23?	60.5
Total	38?	.....

Restricting the comparison still further by eliminating all the genera of wide range, we are able to get a more definite idea of the relationships of the Galapagoan avifauna. Thus limited to American types, its composition appears to be as follows:

Groups of genera.	Number of genera.	Per cent of whole number.
Peculiar genera	6	46.15
Genera common to Central America, the West Indies, and North America	1	7.69
Genera common to South America, Central America, the West Indies and North America	4	30.77
Genera common to Central America and South America	1	7.69
Genera common to South America and the West Indies	1	7.69
Total	13	.....

The foregoing analysis shows that a study of the genera alone will not enable us to decide whether the nonpeculiar portion of the Galapagoan avifauna is most nearly related to that of the adjacent mainland of South America or that of lower Central America or the West

Indies. The species themselves (those peculiar to the group being of course excluded) afford better evidence.

Names of species.	Cocos Island.	Colombian Isthmus north of Panama.	West Indies.	Coast of Ecuador.
1. Dendroica aureola	-	?	-	x
2. Coccyzus melanocoryphus	-	-	-	x
3. Fregata aquila	-	x	x	x
4. Sula cyanops	-	x?	x	?
5. Sula nebouxii	-	x?	-	x
6. Sula brewsteri	-	x?	-	-
7. Sula piscator	-	x?	x	?
8. Phaëthon æthereus	-	?	x	?
9 Ardea herodias?	-	x	x	-
10. Herodias egretta?	-	x	x	x
11. Nyctanassa violacea	-	x	x	-
12. Phœnicopterus ruber	-	?	x	-
13. Gallinula galeata	-	x	x	x
14. Himantopus mexicanus	-	x	x	?
Summary	1	10?	11	6?

Were the above figures correct, they would point very decidedly to a Central American and West Indian origin for the nonpeculiar resident birds of the Galapagos, but unfortunately there are so many interrogation points, indicating doubt in regard to the range of the species, that they can only be accepted as approximately accurate. *Dendroica aureola*, for example, is said to occur at least as far north along the coast of Colombia as Gorgona Island, and may extend as far as the isthmus, if not farther.

Turning now our attention to the six peculiar genera of Galapagos birds, the question of their relationships may be briefly discussed as follows:

(1) *Nesomimus*. This has evidently been derived from *Mimus* (or at least from the same stock), a genus found throughout Central America, the West Indies, and South America, the Galapagos forms being at least as nearly related to the larger West Indian species (*M. hillii*, March) as to any other, and far more nearly than to the single Ecuadorean species (*M. longicaudatus*, Tschudi).[1]

(2) *Certhidea*. This genus was formerly placed among the *Coerebidæ*, but more recently has been transferred to the *Muiotiltidæ*.[2] It has no very near relative among the known continental or West Indian birds, but in general appearance is very much like a smaller "edition" of the Hawaiian genus *Oreomyza*, belonging to the chiefly Polynesian family *Dicæidæ*.

[1] *M. longicaudatus* has, like the North American *M. polyglottos* and allied forms of the Greater Antilles, a white wing-speculum; the Galapagos species of *Nesomimus*, the Central American *Mimus gilvus* (Vieillot), *M. hillii*, and the species of eastern and southern South America have not, except *M. triurus* (Vieillot), which stands quite apart from other species by reason of its unique wing-pattern.

[2] Lucas, Proc. U. S. Nat. Mus., XVII, pp. 309–311.

(3) *Geospiza.* This heteromorphic genus is of very uncertain relationship. Some of the species resemble somewhat the Central American genus *Cyanoloxia*,[1] but perhaps still more the West Indian genus *Melanospiza*,[2] no other American Fringillidæ being enough like *Geospiza* to suggest even distant kinship, unless it be the Central American and South American genus *Oryzoborus*, which, superficially at least, recalls such *Geospizæ* as *G. magnirostris*, *G. pachyrhyncha*, and *G. strenua* in the excessive shortness and thickness of the beak. The more slender-billed species (formerly separated under the generic name *Cactornis*) have no continental or West Indian prototype The only form closely resembling them is the genus *Cocornis*, peculiar to Cocos Island, which is essentially a small, slender-billed "*Cactornis*" with exactly the same sexual and seasonal differences of plumage as the species of "*Cactornis*" and *Geospiza*. It is a singular and most suggestive circumstance that the peculiar departure from the normal fringilline type, begun in the thicker-billed "*Cactorni*" and carried, through a nicely graded transition, to its extreme development in *Cocornis*, should be in the direction of the Hawaiian family mentioned under the head of *Certhidea*.[3]

(4) *Camarhynchus.* This is another heteromorphic genus, whose variations of structure exactly parallel those of *Geospiza*, the longest-billed species (*C. pallidus*) having been originally referred to "*Cactornis*." I have been unable to find a continental or West Indian genus that could be of common origin with it, unless it be the West Indian genus *Pyrrhulagra*. Certainly the western Peruvian genus *Neorhynchus*, the only one which has been mentioned as possibly related,[4] is not its prototype. Certain Hawaiian genera, by some writers referred to the Fringillidæ and by others considered to be thick-billed Dicæidæ, although very different from *Camarhynchus* in coloration, strongly sug-

[1] *Cyanoloxia*, Bonaparte, Conspectus Avium, I, Aug. 15, 1850, p. 502. Type, by elimination, *Coccoborus cyanoides*, Lafresnaye.

[2] *Melanospiza*, Ridgway, new genus. Type, *Loxigilla richardsoni*, Cory.

Generic characters.—Similar to *Geospiza*, Gould (size of type intermediate between *G. fortis* and *G. fuliginosa*), but tail relatively much longer and wing much more rounded (first quill shorter than seventh); mandible relatively broader basally (basal width considerably exceeding length of gonys); culmen quite straight, and mandibular rami much narrower. Coloration: Adult male wholly deep black, except legs and feet, which are brownish white. (Female and young unknown.)

[3] This genus *Cocornis* may possibly furnish the key to the derivation of the family Coerebidæ, since it shows unquestionable resemblance in form to the chiefly West Indian genus *Coereba* (= *Certhiola*, Sundevall). The close resemblance between the adult male of *Cocornis* and the adult (the sexes being alike) of *Coereba atrata* is indeed remarkable, so much so that there can be no doubt, in my mind, that the similarity is something more than merely accidental. That *Cocornis* belongs on the fringilline side of the line, however, is proven by the fact that while the adult male is wholly uniform black the adult female and the young male are varied with olive and rusty above, while their under parts are conspicuously streaked with dusky on a yellowish ground—exactly like the species of *Geospiza;* the sexes of *Coereba*, on the other hand, being alike, and neither the adult nor young streaked beneath.

[4] Salvin, Trans. Zool. Soc. Lond., IX, Pt. IX, 1876, p. 488.

gest relationship in structural characters, the form of the bill in *Loxioides*, *Telespiza*,[1] and *Psittirostra* being not very dissimilar in character to that of some species of *Camarhynchus*.

(5) *Nesopelia*. This genus is closely related to the genus *Zenaida*, of general Neotropical distribution. In fact, it is doubtfully distinct from the latter.

To sum up: Of the five peculiar Galapagoan genera of birds, only two (*Nesomimus* and *Nesopelia*) are of evident American relationship. The remaining three have so obvious a leaning toward certain Hawaiian dicæidine forms[2] that the possibility of a former land connection, either continuous or by means of intermediate islands as "stepping stones," becomes a factor in the problem. It may be that the resemblance of *Cocornis*, "*Cactornis*," and *Camarhynchus* to the above-mentioned Hawaiian forms is merely a superficial one, and not indicative of real relationship. I do not by any means claim, on the strength of such evidence, a common origin for them, but merely present the facts as "food for reflection."[3]

It will doubtless seem to some that I have gone to an undesirable if not reprehensible extreme in naming so many forms of the genera *Certhidea*, *Geospiza*, *Camarhynchus*, and *Pyrocephalus*. Whether such is true or not, I have certainly not been actuated by any desire to add to the number of species. On the contrary, several names, chiefly of my own, have been relegated to synonymy in consequence of what seemed to be good evidence of their untenability; and in naming new ones I have in all cases been guided by definite principles without regard to the character of the criticism which might result. Some of these new names may, when additional material has been secured, prove also to be untenable, and will then have to be "degraded;" but the decision of such questions should always be a matter of evidence, never of individual opinion or prejudice; and I am sure that all who have had equal experience in the laborious and time-consuming task of dissecting and reconstructing synonymies will bear me witness that the real promoter

[1] At least what I take to be *Telespiza flavissima*, Rothschild, but, not being able to refer to the "Avifauna of Laysan," the identification is doubtful. The bird was taken on the island of Laysan by Mr. W. T. Brigham, and is No. 128455, U.S.N.M.

[2] Whether the genera *Loxioides*, *Telespiza*, *Psittirostra*, and other finchlike Hawaiian forms are true Fringillidæ or thick-billed Dicæidæ can scarcely be said to be yet satisfactorily decided.

[3] While the prevailing *facies* of the Hawaiian avifauna is unquestionably Polynesian, a small but by no means insignificant American element is present. How it came there has not yet been explained. Of land birds, the peculiar genus *Phæornis* is most like *Myadestes*, of America (see Stejneger, Proc. U. S. Nat. Mus., X, 1887, p. 92, and XII, 1889, pp. 383, 384). The American *Circus hudsonius* occurs also in Hawaii; the Hawaiian *Gallinula* is barely separable from the American species, *G. galeata*, and the *Plegadis* seems to be identical with *P. guarauna*. The *Himantopus* is nearly related to *H. mexicanus*, and *Anas wyvilliana* is very similar to *A. aberti* of western Mexico. Two of the Hawaiian Procellariidæ, *Estrelata phæopygia* and *Oceanodroma cryptoleucura* occur also in the Galapagos!

of chaos and enemy of order is the "lumper," and not his much maligned co-worker, the "hair-splitter."

When it is remembered that the coloration is practically if not absolutely the same in all of the twenty-odd forms of the genus *Geospiza*, it will be seen that if any segregation of species is made at all it must be based upon measurements; and when it is further seen that there is a gradual transition in size from the enormous beak of *G. magnirostris* to the comparatively minute one of *G. parvula* (see Plate LVII) and from the excessively thick one of *G. pachyrhyncha* (whose lateral outlines approximate an equilateral triangle) to the slender and curved one of *G. scandens* or the acuminate one of *G. acutirostris;* and that size of beak is not necessarily correlated with length of wing, tarsus, etc., the difficulty of defining the species becomes obvious. In fact, the segregation of definable forms would not be possible were there not a reasonable uniformity of measurements among specimens from one locality, it being usually the case that when a great difference in size between specimens from any one island is observed, the specimens can easily be divided into two or more (rarely as many as seven) sets, whose measurements do not inosculate, the individuals whose measurements are intermediate coming from some other island. Some islands, unfortunately, are so poorly represented by specimens that much doubt must necessarily exist respecting the forms which are found upon them.

Having been perplexed by these difficulties, I have carefully weighed all doubtful cases, and whenever there seemed to be a well-defined average difference between specimens from different islands, I have not hesitated to separate them as local forms. No other course, indeed, is practicable; for were "lumping" once begun there could be no end to it, unless purely arbitrary limits were given to the species recognized, and if followed to a logical conclusion might easily end in the recognition of a single variable species, equivalent in its limits to the genus.

How many fairly good species there really are in the genus it is not possible for me to conjecture from the insufficient material that I have been able to examine. A considerable number of the forms recognized in this work are undoubtedly mere local races. Insular forms, however, can hardly be treated in the same manner as continental ones, whose conditions of environment are so much more favorable to intergradation; hence I have treated alike as species all the forms that it has seemed worth while to distinguish by a separate name. Regarding supposed excessive individual variation in the genus *Geospiza*, I am unable to agree entirely with Mr. Salvin,[1] who has, I think, made the specific limits too wide, and thus brought together under one specific name forms from different islands which are really more or less distinct. Indeed I have failed to discover in the series of specimens from any one island a greater range of variation in measurements than often exists among an equal number of specimens of mainland forms. (See under genus *Geospiza*, p. 508.)

[1] Trans. Zool. Soc. London, IX, Pt. IX, 1876, pp. 479–484.

LISTS OF SPECIES OF BIRDS FOUND UPON EACH ISLAND OF THE GALAPAGOS ARCHIPELAGO.

In the following lists of species which have thus far been taken upon or (in the cases of sea birds) near by each island, I give, in chronological order, the authorities upon which the records are based. I have not deemed it worth while to give a description of each island, this having already been done so well by Mr. Salvin[1] and Professor Agassiz.[2]

List of birds ascertained to occur on Albemarle Island.

[Peculiar species in italic.]

Names of species.	Darwin, 1835.	Néboux, 1836–1839.	Kimberg, 1852.	Kellett and Wood, ——	Habel, 1868.	Cookson, 1875.	Markham, 1880.	Jones, 1884.	"Albatross," 1888.	Townsend, 1891.	Baur and Adams, 1891.
1. Nesomimus *parvulus*	x	....	....	....	....	x	....	....	x	....	x
2. Dendroica aureola	....	....	....	....	[x]	....	....	....	....	....	x
3. Certhidea *albemarlei*	....	....	....	....	....	....	....	....	....	....	x
4. Geospiza magnirostris?	....	....	....	....	....	....	....	....	....	....	ax
5. Geospiza fortis	....	....	....	....	....	....	....	....	x	....	x
6. Geospiza fuliginosa	....	....	....	....	....	x	....	....	x	....	x
7. Geospiza fatigata?	....	....	....	....	....	....	....	....	....	....	x
8. Camarhynchus variegatus	....	....	....	....	b[x?]	....	....	....	....	....	x
9. Camarhynchus *affinis*	....	....	....	....	....	....	....	....	....	....	x
10. Camarhynchus prosthemelas	....	....	....	....	....	....	....	....	....	....	x
11. Camarhynchus *productus*	....	....	....	....	....	....	....	....	....	....	x
12. Myiarchus magnirostris	....	....	....	....	....	....	....	....	....	....	x
13. Pyrocephalus intercedens	....	....	....	....	....	....	....	....	....	....	x
14. Asio galapagoensis	....	....	....	....	....	....	....	....	....	....	x
15. Buteo galapagoensis	....	....	....	....	....	....	....	....	....	....	x
16. Pelecanus californicus	....	....	....	....	....	....	....	....	....	....	x
17. Sula nebouxii	....	....	....	....	....	....	....	....	....	....	x
18. Herodias egretta?	....	....	....	....	....	....	....	....	....	....	x
19. Butorides plumbeus	....	....	....	....	....	....	....	....	....	....	x
20. Nyctanassa violacea	....	....	....	....	....	....	....	....	....	....	x
21. Pecilonetta galapagensis	....	....	....	....	....	....	....	....	....	....	x
22. Nesopelia galapagoensis	....	....	....	....	[x]	....	....	....	....	....	....
23. Gallinula galeata?	....	....	....	....	....	....	....	....	....	....	x
24. Hæmatopus galapagensis	....	....	....	....	....	....	....	....	....	....	x
25. Arenaria interpres	....	....	....	....	....	....	....	....	....	....	x
26. Squatarola squatarola	....	....	....	....	....	....	....	....	....	....	x
27. Ægialitis semipalmata	....	....	....	....	....	....	....	....	....	....	x
28. Calidris arenaria	....	....	....	....	....	....	....	....	....	....	x
29. Heteractitis incanus	....	....	....	....	....	....	....	....	....	....	x
30. Numenius hudsonicus	....	....	....	....	....	....	....	....	....	....	x
31. Himantopus mexicanus?	....	....	....	....	....	....	....	....	....	....	x
32. Anous galapagensis	....	....	....	....	....	....	....	....	....	....	x
33. Oceanodroma cryptoleucura	....	....	....	....	....	....	....	....	....	x	....
34. Oceanites gracilis	....	....	....	....	....	....	....	....	....	....	x
35. Spheniscus mendiculus	....	....	....	....	....	....	....	....	x	....	x
Total by each collector	1	0	0	0	[3]	2	0	0	4	1	33

a See. Amer. Nat., XXV, 1891, p. 905.

b "*C. habeli*" of Trans. Zool. Soc. Lond., IX, Pt. IX, p. 460†.

Messrs. Baur and Adams collected at two points on Albemarle Island—"East Albemarle, opposite Cowley Island," and "South Albemarle."

[1] Trans. Zool. Soc. Lond., IX, Pt. IX, 1876, pp. 447–461.

[2] Bull. Mus. Comp. Zool., Harvard College, XXIII, No. 1, 1892, pp. 63–74.

The brief notes which Dr. Baur has kindly sent me concerning the collections made at the two localities are as follows:

East Albemarle opposite Cowley Island.—Composition of fauna different from that of South Albemarle. Large *Geospiza*[1] absent; many black individuals of *fortis* and *fuliginosa*.

Cactornis rare, only black specimens seen.

Camarhynchus, two species [*affinis* and *prosthemelas*]; large form [*variegatus*] absent.

Nesomimus, *Certhidea*, *Myiarchus*, and *Pyrocephalus* present, but not common.

South Albemarle.—*Geospiza*, three species [*fortis*, *fuliginosa*, and a large form, doubtless either *G. strenua* or *G. magnirostris*—most likely the former].

Cactornis, two species, the large blackish species [*Geospiza fatigata?*] common. [The other one is *Camarhynchus productus*.]

Nesomimus [*parvulus*] common.

Certhidea [*albemarlei*] common.

Pyrocephalus [*intercedens*] common, but red males rare.

Myiarchus [*magnirostris*] common.

Dendroica, *Buteo*, *Pœcilonetta*, common.

Spheniscus, very common.

As Dr. Baur, and his associate, Mr. Adams, collected more than forty species on South Albemarle, there are at least twenty-five species found there which are as yet unidentified.

List of birds ascertained to occur on Duncan Island.

Names of species.	Darwin, 1835.	Néboux, 1836–1839.	Kinberg, 1852.	Kellett and Wood, —.	Habel, 1868.	Cookson, 1875.	Markham, 1880.	Jones, 1884.	"Albatross," 1888.	Townsend, 1891.	Baur and Adams, 1891.
1. Dendroica aureola											x
2. Certhidea (undetermined)											x
3. Geospiza fortis											x
4. Geospiza fuliginosa									x	x	x
5. Geospiza (undetermined) *a*											x
6. Camarhynchus (undetermined) *b*									x		
7. Myiarchus magnirostris									x	x	x
8. Pyrocephalus (undetermined)											x
9. Buteo galapagoensis											x
10. Ardea herodias?									x		
11. Butorides plumbeus									x	x	
12. Pœcilonetta galapagensis											x
13. Nesopelia galapagoensis									x	x	
Total by each collector	0	0	0	0	0	0	0	0	6	4	9

a One of the so-called *Cactorni*, probably *G. fatigata*.

b Perhaps *C. affinis*.

[1] What this large species of South Albemarle could have been, I can only conjecture; perhaps *G. strenua*, possibly *G. magnirostris*.

List of birds ascertained to occur on Brattle Island.

Names of species.	Darwin, 1835.	Néboux, 1836-1839.	Kinberg, 1852.	Kellett and Wood, ——.	Habel, 1868.	Cookson, 1875.	Jones, 1884.	"Albatross," 1888.	Townsend, 1891.	Baur and Adams, 1891.
1. Sula nebouxii	....	....	....	....	....	....	....	....	....	*a* x
2. Creagrus furcatus	....	....	....	....	....	....	....	....	....	x
Total by each collector	0	0	0	0	0	0	0	0	0	2

a Breeding.

List of birds ascertained to occur on Charles Island.

Names of species.	Darwin, 1835.	Néboux, 1836-1839.	Kinberg, 1852.	Kellett and Wood, ——.	Habel, 1868.	Cookson, 1875.	Markham, 1880.	Jones, 1884.	"Albatross," 1888.	Townsend, 1891.	Baur and Adams, 1891.
1. Nesomimus *trifasciatus*	x	....	x	....	....	....	....	....	....	....	....
2. Nesomimus melanotis?	....	....	x	....	....	....	....	....	....	....	....
3. Dendroica aureola	x?	....	x	....	....	x	....	....	x	x	....
4. Progne modesta	....	x	....	....	....	....	....	....	....	....	....
5. Geospiza magnirostris	x	....	....	....	....	....	....	....	....	....	....
6. Geospiza strenua	....	....	....	....	....	....	....	....	x	....	....
7. Geospiza fortis	x	....	x	....	....	....	....	....	x	x	x
8. Geospiza fuliginosa	....	....	x	....	....	....	....	....	x	x	....
9. Geospiza dentirostris	....	....	....	....	....	....	x	....	....	....	....
10. Geospiza difficilis?	....	....	....	....	....	....	x	....	....	....	....
11. Geospiza *intermedia*	....	x	x	....	....	....	....	....	x	x	x
12. Geospiza brevirostris	....	....	....	....	....	....	....	....	x	....	....
13. Camarhynchus crassirostris	x?	....	....	....	....	....	....	....	....	....	....
14. Camarhynchus variegatus	....	....	....	....	....	....	....	....	x	x	x
15. Camarhynchus psittaculus?	....	....	....	....	....	....	....	....	x	....	....
16. Camarhynchus *pauper*	....	....	....	....	....	....	....	....	x	....	....
17. Camarhynchus prosthemelas	....	....	x	....	....	....	....	....	x	....	x
18. Myiarchus magnirostris	....	....	x	....	....	....	....	....	x	x	x
19. Pyrocephalus *carolensis*	x?	....	....	....	....	x	....	....	x	x	x
20. Coccyzus melanocoryphus	....	....	....	....	....	....	....	....	x	x	x
21. Pelecanus californicus	....	....	....	....	....	....	x	....	....	....	x
22. Sula cyanops	....	....	....	....	....	....	x	....	....	....	....
23. Sula nebouxii	....	....	....	....	....	....	....	....	....	....	x
24. Butorides plumbeus	....	....	....	....	....	....	....	....	....	....	x
25. Phœnicopterus ruber	....	....	....	....	....	....	....	....	x	....	x
26. Pœcilonetta galapagensis	....	....	....	....	....	....	x	....	x	....	x
27. Nesopelia galapagoensis	....	x	....	....	....	....	....	x	....	....	....
28. Numenius borealis	....	....	....	....	....	....	x	....	....	....	....
29. Larus fuliginosus	x?	....	x	....	....	....	....	....	....	....	x
30. Anous galapagensis	....	....	....	....	....	....	x	....	....	....	....
31. Puffinus subalaris?	....	....	....	....	....	....	x	....	....	....	....
32. Spheniscus mendiculus *a*	....	....	....	....	....	....	....	....	....	....	....
Total by each collector	5	3	8	0	0	2	8	1	15	8	13

a Wolf, Ein Besuch aus den Galápagos-Inseln, p. 42.

List of birds ascertained to occur on Hood Island.

Names of species.	Darwin, 1835.	Néboux, 1836–1839.	Kinberg, 1852.	Kellett and Wood, —.	Habel, 1868.	Cookson, 1875.	Markham, 1880.	Jones, 1884.	"Albatross," 1888.	Townsend, 1891.	Baur and Adams, 1891.
1. Nesomimus *macdonaldi*					[x]				x		x
2. Dendroica aureola					[x]						x
3. Certhidea *cinerascens*									x		x
4. Geospiza *conirostris*									x		x
5. Geospiza *media*									x		
6. Geospiza fuliginosa									x		x
7. Myiarchus magnirostris									x		x
8. Asio galapagoensis					[x]						x
9. Buteo galapagoensis					[x]						
10. Sula nebouxii					[x]						
11. Butorides plumbeus									x		x
12. Nyctanassa violacea									x		x
13. Pœcilonetta galapagensis					[x]						x
14. Nesopelia galapagoensis					[x]				x		
15. Hæmatopus galapagensis											x
16. Arenaria interpres									x		
17. Heteractitis incanus									x		
18. Creagrus furcatus											x
19. Anous galapagensis									x		x
20. Diomedea exulans *a*					[x?]						
21. Diomedea nigripes??					[x]						
Total by each collector	0	0	0	0	[9]	0	0	0	12	0	13

a Wolf, Ein Besuch aus den Galápagos-Inseln, 1879, p. 13. Perhaps one of the "two kinds of Albatrosses" seen at Hood Island by Dr. Habel (see Trans. Zool. Soc., IX, Pt. IX, 1876, pp. 458, 459) was this species.

List of birds ascertained to occur on Chatham Island.

Names of species.	Darwin, 1835.	Néboux, 1836–1839.	Kinberg, 1852.	Kellett and Wood, —.	Habel, 1868.	Cookson, 1875.	Markham, 1880.	Jones, 1884.	"Albatross," 1888.	Townsend, 1891.	Baur and Adams, 1891.
1. Nesomimus *adamsi*	x		x						x	x	x
2. Dendroica aureola	x?		x					x	x	x	x
3. Certhidea *luteola*	x								x	x	x
4. ?Progne modesta? *a*											
5. Geospiza magnirostris	x										
6. Geospiza strenua	x										
7. Geospiza dubia	x		x						x	x	x
8. Geospiza fuliginosa	x		x						x	x	x
9. Geospiza parvula			x							x	
10. ?Geospiza dentirostris *b*											
11. Geospiza fatigata ??						z			x		
12. Camarhynchus variegatus									x	x	x
13. Camarhynchus *salvini*			x						x	x	x
14. Myiarchus magnirostris	x		x						x	x	x
15. Pyrocephalus *dubius*	x?								x		x
16. Coccyzus melanocoryphus									x		x
17. Buteo galapagoensis	x?							x			x
18. Fregata aquila											x
19. Pelecanus californicus									x		x
20. Sula nebouxii									x		x
21. Butorides plumbeus								x			
22. Nyctanassa violacea											x

a See Sharpe, Cat. Birds Brit. Mus., X, 1885, p. 176. *b* Fide Sharpe, Cat. Birds Brit. Mus., XII, p. 12.

List of birds ascertained to occur on Chatham Island—Continued.

Names of species.	Darwin, 1835.	Néboux, 1836-1839.	Kinberg, 1852.	Kellett and Wood, —.	Habel, 1868.	Cookson, 1875.	Markham, 1880.	Jones, 1884.	"Albatross," 1888.	Townsend, 1891.	Baur and Adams, 1891.
23. Pœcilonetta galapagensis	....	....	....	....	....	....	....	....	....	x	x
24. Nesopelia galapagoensis	....	....	....	....	....	....	....	x	....	....	x
25. Hæmatopus galapagensis	....	....	....	....	....	....	....	x	....	....	....
26. Numenius hudsonicus	....	....	....	....	....	....	....	....	....	....	[x]
27. Himantopus mexicanus	....	....	....	....	....	....	....	....	....	....	x
28. Larus fuliginosus	....	....	....	....	....	....	....	....	x	x	x
29. Creagrus furcatus	....	....	....	x	....	....	....	....	x	....	....
30. Anous galapagensis	....	....	....	x	....	....	....	....	x	....	....
31. Aestrelata phæopygia	....	....	....	x	....	....	....	....	....	....	....
32. Puffinus subalaris	....	....	....	....	....	....	....	....	....	x	....
Total by each collector	10	0	7	3	0	0	0	5	16	14	20

According to Dr. Baur,[1] the fauna of the northern part of Chatham Island is different from that of the southern portion, where collections have chiefly been made, the absence of *Nesomimus*, *Certhidea*, and *Camarhynchus* from the northern part being particularly noted.

List of birds ascertained to occur on Barrington Island.

Names of species.	Darwin, 1835.	Néboux, 1836-1839.	Kinberg, 1852.	Kellett and Wood, —.	Habel, 1868.	Cookson, 1875.	Markham, 1880.	Jones, 1884.	"Albatross," 1888.	Townsend, 1891.	Baur and Adams, 1891.
1. Nesomimus (undetermined)	....	....	....	....	....	....	....	....	....	....	x
2. Dendroica aureola	....	....	....	....	....	....	....	....	....	....	x
3. Certhidea *bifasciata*	....	....	....	....	....	....	....	....	....	....	x
4. Geospiza (undetermined) *a*	....	....	....	....	....	....	....	....	....	....	x
5. Geospiza parvula?	....	....	....	....	....	....	....	....	....	....	x
6. Geospiza *barringtoni*	....	....	....	....	....	....	....	....	....	....	x
7. Camarhynchus (undetermined) *b*	....	....	....	....	....	....	....	....	....	....	x
8. Myiarchus magnirostris	....	....	....	....	....	....	....	....	....	....	x
9. Buteo galapagoensis	....	....	....	....	....	....	....	....	....	....	x
10. Fregata aquila	....	....	....	....	....	....	....	....	....	....	x
11. Pelecanus californicus	....	....	....	....	....	....	....	....	....	....	x
12. Sula nebouxii	....	....	....	....	....	....	....	....	....	....	x
13. Butorides plumbeus	....	....	....	....	....	....	....	....	....	....	x
14. Pœcilonetta galapagensis	....	....	....	....	....	....	....	....	....	....	x
15. Larus fuliginosus	....	....	....	....	....	....	....	....	....	....	x
Total by each collector	0	0	0	0	0	0	0	0	0	0	15

a "The median form observed." (Baur.) *b* "One specimen (the middle form) collected." (Baur.)

[1] Amer. Nat., 1891, XXV, p. 904, footnote.

List of birds ascertained to occur on Indefatigable Island.

Names of species.	Darwin, 1835.	Nôbours, 1836-1839.	Kinberg, 1852.	Kellett and Wood, ——	Habel, 1869.	Cookson, 1875.	Markham, 1880.	Jones, 1884.	"Albatross," 1888.	Townsend, 1891.	Baur and Adams, 1891.
1. Nesomimus melanotis	....	....	^	....	x	....	....	....	x	^	x
2. Dendroica aureola	....	....	....	....	x	....	....	....	x	....	x
3. Certhidea *salvini*	....	....	....	....	x	....	....	....	....	....	x
4. Progne modesta	....	....	....	....	[x]	....	....	....	x	....	....
5. Geospiza strenua	....	....	....	....	x	....	....	....	....	....	....
6. Geospiza fortis	....	....	....	....	x	....	....	....	x	....	....
7. Geospiza fuliginosa	....	....	....	....	x	....	....	....	x	....	....
8. Geospiza parvula	....	....	....	....	....	....	....	....	....	....	x
9. Geospiza fatigata	....	....	....	....	x	....	....	....	x	....	x
10. Geospiza brevirostris?	....	....	....	....	x	....	....	....	....	....	....
11. Camarhynchus variegatus	....	....	....	....	....	....	....	....	x	....	....
12 Camarhynchus psittaculus	....	....	....	....	x	....	....	....	x	....	....
13. Camarhynchus prosthemelas	....	....	....	....	x	....	....	....	....	....	x
14. Camarhynchus pallidus	....	....	....	....	x	....	....	....	....	....	x
15. Myiarchus magnirostris	....	....	....	....	x	....	....	....	x	....	x
16. Pyrocephalus nanus	x?	....	x	....	x	....	....	....	x	....	x
17. Strix punctatissima	....	....	....	....	x	....	....	....	....	....	....
18. Asio galapagoensis	....	....	....	....	x	....	....	....	....	....	....
19. Buteo galapagoensis	x?	....	....	....	x	....	....	....	x	....	x
20. Sula piscator	....	....	....	....	....	....	....	....	....	....	x
21. Ardea herodias?	....	....	....	....	x	....	....	....	....	....	....
22. Butorides plumbeus	....	....	....	....	x	....	....	....	....	....	....
23. Nyctanassa violacea	....	....	....	....	x	....	....	....	x	....	....
24. Phœnicopterus ruber	....	....	....	....	[x]	....	....	....	....	....	....
25. Pœciloneta galapagensis	....	....	....	....	x	....	....	....	....	x	x
26. Nesopelia galapagoensis	x?	....	....	....	x	....	....	....	x	....	....
27. Porzana spilonota	....	....	....	....	x	....	....	....	....	....	....
28. Hæmatopus galapagensis	....	....	....	....	x	....	....	....	....	x	....
29. Arenaria interpres	....	....	....	....	x	....	....	....	....	....	....
30. Ægialitis semipalmata	....	....	....	....	x	....	....	....	....	....	....
31. Tringa minutilla	....	....	....	....	x	....	....	....	....	....	....
32. Heteractitis incanus	....	....	....	....	x	....	....	....	....	....	....
33. Numenius hudsonicus	....	....	....	....	x	....	....	....	....	....	....
34. Himantopus mexicanus	....	....	....	....	x	....	....	....	....	....	....
35. Larus fuliginosus	x?	....	x	....	x	....	....	....	x	....	....
36. Aestrelata phæopygia	....	....	....	....	....	....	....	....	....	....	ax
Total by each collector	4?	0	3	0	32	0	0	0	14	3	13

a Off pass between Indefatigable and James islands and between Barrington and Indefatigable islands.

Doctor Habel saw in the Puerta de la Aguada on Indefatigable Island "two species of swallows. One, a large kind, kept to the perpendicular rocks which lined the estuary, and did not fly inland; the other, smaller, flew about the island, but too rapidly to be shot by me." The first-mentioned species is with scarcely any doubt *Progne modesta;* but the second has not yet been seen by other explorers, and therefore remains unidentified. It may possibly be a species of swift, perhaps of the genus *Chætura.*

List of birds ascertained to occur on Jervis Island.

Names of species.	Darwin, 1835.	Néboux, 1836–1839.	Kinberg, 1852.	Kellett and Wood, ——.	Habel, 1868.	Cookson, 1875.	Markham, 1880.	Jones, 1884.	"Albatross," 1888.	Townsend, 1891.	Baur and Adams, 1891.
1. Nesomimus melanotis	....	....	....	....	....	....	....	....	....	....	×
2. Dendroica aureola	....	....	....	....	....	....	....	....	....	....	×
3. Certhidea (undetermined)	....	....	....	....	....	....	....	....	....	....	×
4. Geospiza magnirostris? *a*	....	....	....	....	....	....	....	....	....	....	×
5. Geospiza (undetermined) *b*	....	....	....	....	....	....	....	....	....	....	×
6. Geospiza (undetermined)	....	....	....	....	....	....	....	....	....	....	×
7. Geospiza fatigata?	....	....	....	....	....	....	....	....	....	....	×
8. Camarhynchus psittaculus	....	....	....	....	....	....	....	....	....	....	×
9. Camarhynchus *compressirostris*	....	....	....	....	....	....	....	....	....	....	×
10. Camarhynchus prosthemelas	....	....	....	....	....	....	....	....	....	....	×
11. Camarhynchus pallidus	....	....	....	....	....	....	....	....	....	....	×
12. Myiarchus magnirostris	....	....	....	....	....	....	....	....	....	....	×
13. Pyrocephalus nanus? *c*	....	....	....	....	....	....	....	....	....	....	×
14. Pœcilonetta galapagensis	....	....	....	....	....	....	....	....	....	....	×
15. Puffinus subalaris?	....	....	....	....	....	....	....	....	....	....	×
Total by each collector	0	0	0	0	0	0	0	0	0	0	15

a Baur, Amer. Nat., XXV, 1891, p. 905.
b "Three species of *Geospiza*, the middle form common." (Baur.)
c "Rare; only one specimen seen and procured." (Baur.)

List of birds ascertained to occur on James Island.

Names of species.	Darwin, 1835.	Néboux, 1836–1839.	Kinberg, 1852.	Kellett and Wood, ——.	Habel, 1868.	Cookson, 1875.	Markham, 1880.	Jones, 1884.	"Albatross," 1888.	Townsend, 1891.	Baur and Adams, 1891.
1. Nesomimus melanotis	×	....	×	....	....	....	....	....	×	....	×
2. Dendroica aureola	×?	....	×	....	....	....	....	....	×	....	×
3. Certhidea *olivacea*	×	....	....	....	....	....	....	....	×	....	×
4. Progne modesta	×	....	×	....	....	....	....	....	....	....	....
5. Geospiza strenua	×	....	×	....	....	....	....	....	....	....	....
6. Geospiza *bauri*	....	....	....	....	....	....	....	....	....	....	×
7. Geospiza fortis	....	....	×	....	....	....	....	....	×	....	....
8. Geospiza fuliginosa	×	....	×	....	....	....	....	....	×	....	×
9. Geospiza parvula	×	....	....	....	....	....	....	....	....	....	....
10. Geospiza *debilirostris*	....	....	....	....	....	....	....	....	×	....	....
11. Geospiza *scandens*	×	....	×	....	....	....	....	....	....	....	×
12. Geospiza assimilis?	....	....	....	....	....	....	....	....	....	....	×
13. Camarhynchus variegatus	....	....	....	....	....	....	....	....	....	....	×
14. Camarhynchus psittaculus	×	....	....	....	....	....	....	....	×	....	×
15. Camarhynchus *incertus*	....	....	....	....	....	....	....	....	....	....	×
16. Camarhynchus prosthemelas	....	....	×	....	....	....	....	....	×	....	×
17. Camarhynchus pallidus	....	....	....	....	....	....	....	....	×	....	×
18. Dolichonyx oryzivorus	×	....	....	....	....	....	....	....	....	....	....
19. Myiarchus magnirostris	....	....	×	....	....	....	....	....	×	....	×
20. Pyrocephalus nanus	×?	....	×	....	....	....	....	....	×	....	×
21. Strix punctatissima	×	....	....	....	....	....	....	....	....	....	....
22. Asio galapagoensis	×	....	....	....	....	....	....	....	....	....	....
23. Buteo galapagoensis	×	....	....	....	....	....	....	....	....	....	....
24. Butorides plumbeus	....	....	×	....	....	....	....	....	×	....	×
25. Phœnicopterus ruber	....	....	....	....	....	....	....	....	×	....	×
26. Pœcilonetta galapagensis	....	....	....	....	....	....	....	....	....	....	×
27. Nesopelia galapagoensis	....	....	×	....	....	....	....	....	×	....	×
28. Porzana spilonota	×	....	....	....	....	....	....	....	....	....	....
29. Hæmatopus galapagensis	....	....	....	....	....	....	....	....	×	....	....
30. Heteractitis incanus	....	....	....	....	....	....	....	....	×	....	....

List of birds ascertained to occur on James Island—Continued.

Names of species.	Darwin, 1835.	Néboux, 1836-1839.	Kinberg, 1852.	Kellett and Wood, ——.	Habel, 1868.	Cookson, 1875.	Markham, 1880.	Jones, 1884.	"Albatross," 1888.	Townsend, 1891.	Baur and Adams, 1891.
31. Himantopus mexicanus									x		
32. Larus fuliginosus	x								x		
33. Creagrus furcatus											x
34. Aestrelata phæopygia											a x
35. Oceanites gracilis											x
36. Sphenisicus mendiculus			x								[x]
Total by each collector	16?	0	13	0	0	0	0	0	18	0	22

a "Off pass between Indefatigable and James islands."

List of birds ascertained to occur on Tower Island.

Names of species.	Dawin, 1835.	Néboux, 1836-1839.	Kinberg, 1852.	Kellett and Wood, ——.	Habel, 1868.	Cookson, 1875.	Markham, 1880.	Jones, 1884.	"Albatross," 1888.	Townsend, 1891.	Baur and Adams, 1891.
1. Nesomimus *bauri*											x
2. Dendroica aureola											x
3. Certhidea *mentalis*											x
4. Geospiza *pachyrhyncha*											x
5. Geospiza *acutirostris*											x
6. Geospiza *propinqua*											x
7. Asio galapagoensis											x
8. Fregata aquila					[x]						x
9. Fregata aquila minor											x
10. Sula cyanops											x
11. Sula piscator					a [x]						x
12. Sula brewsteri?					a [x]						
13. Phaëthon æthereus					[x]						x
14. Pœcilonetta galapagensis											x
15. Nesopelia galapagoensis											[x]
16. Creagrus furcatus											x
17. Anous galapagensis											x
Total by each collector	0	0	0	0	[4]	0	0	0	0	0	16

a See Trans. Zool. Soc. Lond., IX, Pt. IX, 1876, p. 460.

List of birds ascertained to occur on Bindloe Island.

Names of species.	Darwin, 1835.	Nèboux, 1836-1839.	Kinberg, 1852.	Kellett and Wood, —.	Habel, 1868.	Cookson, 1875.	Markham, 1880.	Jones, 1884.	"Albatross," 1888.	Townsend, 1891.	Baur and Adams, 1891.
1. Nesomimus *bindloei*	....	....	....	....	....	....	....	....	....	....	x
2. Dendroica aureola	x?	....	....	....	x	....	....	....	....	....	....
3. Certhidea (fusca?)	....	....	....	....	x	....	....	....	....	....	....
4. Geospiza strenua	....	....	....	....	x	....	....	....	....	....	....
5. Geospiza fortis	....	....	....	....	x	....	....	....	....	....	....
6. Geospiza parvula	....	....	....	....	x	....	....	....	....	....	....
7. Geospiza assimilis	....	....	....	....	x	....	....	....	....	....	....
8. Camarhynchus variegatus	....	....	....	....	x	....	....	....	....	....	....
9. Camarhynchus *bindloei*	....	....	....	....	x	....	....	....	....	....	....
10. Myiarchus magnirostris	....	....	....	....	x	....	....	....	....	....	....
11. Pyrocephalus (abingdoni?)	....	....	....	....	x	....	....	....	....	....	[x]
12. Asio galapagoensis	....	....	....	....	....	....	....	....	....	....	x
13. Buteo galapagoensis	....	....	....	....	....	....	....	....	....	....	x
14. Fregata aquila	....	....	....	....	....	....	....	....	....	....	x
15. Pelecanus californicus	....	....	....	....	....	....	....	....	....	....	[x]
16. Sula nebouxii	....	....	....	....	....	....	....	....	....	....	x
17. Sula brewsteri	....	....	....	....	....	....	....	....	....	....	[x]
18. Nesopelia galapagoensis	....	....	....	....	x	....	....	....	....	....	....
19. Hæmatopus galapagensis	....	....	....	....	....	....	....	....	....	....	[x]
20. Arenaria interpres	....	....	....	....	x	....	....	....	....	....	....
21. Calidris arenaria	....	....	....	....	x	....	....	....	....	....	....
22. Larus fuliginosus	....	....	....	....	....	....	....	....	....	....	[x]
Total by each collector	1?	0	0	0	13	0	0	0	0	0	10

List of birds ascertained to occur on Abingdon Island.

Names of species.	Darwin, 1835.	Nèboux, 1836-1839.	Kinberg, 1852.	Kellett and Wood, —.	Habel, 1868.	Cookson, 1875.	Markham, 1880.	Jones, 1884.	"Albatross," 1888.	Townsend, 1891.	Baur and Adams, 1891.
1. Nesomimus *personatus*	....	....	....	....	....	....	....	....	x	....	x
2. Dendroica aureola	....	....	....	....	x	....	....	....	x	....	....
3. Certhidea fusca	....	....	....	....	x	....	....	....	x	....	....
4. Geospiza strenua	....	....	....	....	x	....	....	....	x	....	....
5. Geospiza *fraterculus*	....	....	....	....	x	....	....	....	x	....	....
6. Geospiza fuliginosa	....	....	....	....	x	....	....	....	x	....	....
7. Geospiza parvula	....	....	....	....	x	....	....	....	x	....	....
8. Geospiza difficilis	....	....	....	....	x	....	....	....	x	....	....
9. Geospiza *abingdoni*	....	....	....	....	x	....	....	....	x	....	....
10. Camarhynchus variegatus	....	....	....	....	x?	....	....	....	....	....	....
11. Camarhynchus *habeli*	....	....	....	....	x	....	....	....	x	....	....
12. Myiarchus magnirostris	....	....	....	....	x	....	....	....	x	....	....
13. Pyrocephalus abingdoni	....	....	....	....	....	....	....	....	x	....	....
14. Strix punctatissima	....	....	....	....	x	....	....	....	....	....	....
15. Buteo galapagoensis	....	....	....	....	x	....	....	....	x	....	....
16. Butorides plumbeus	....	....	....	....	....	....	....	....	x	....	....
17. Heteractitis incanus	....	....	....	....	x	....	....	....	....	....	....
18. Larus fuliginosus	....	....	....	....	x	....	....	....	....	....	....
Total by each collector	0	0	0	0	15?	0	0	0	13	0	1

Among the few birds collected on Abingdon Island, Dr. Baur mentions, in a letter, "a black *Geospiza* with a yellow bill." Whether this

is one of the species named in the above list or an additional one, it is of course impossible to tell in the absence of specimens.

List of birds ascertained to occur on Wenman Island.

Names of species.	Darwin, 1835.	Néboux, 1836–1839.	Kinberg, 1852.	Kellett and Wood, ——.	Habel, 1868.	Cookson, 1875.	Markham, 1880.	Jones, 1884.	"Albatross," 1888.	Townsend, 1891.	Baur and Adams, 1891.
1. Sula piscator	....	....	....	....	....	....	....	....	....	....	a
2. Anous galapagensis	....	....	....	....	....	....	....	....	....	x	....
3. Puffinus subalaris	....	....	....	....	....	....	....	....	....	x	....
4. Oceanodroma cryptoleucura	....	....	....	....	....	....	....	....	....	x	....
5. Procellaria tethys	....	....	....	....	....	....	....	....	....	x	....
Total by each collector	0	0	0	0	0	0	0	0	0	4	1

List of birds ascertained to occur on Cowley Island.

Names of species.	Darwin, 1835.	Néboux, 1836–1839.	Kinberg, 1852.	Kellett and Wood, ——.	Habel, 1868.	Cookson, 1875.	Markham, 1880.	Jones, 1884.	"Albatross," 1888.	Townsend, 1891.	Baur and Adams, 1891.
1. Sula brewsteri?	....	....	....	....	....	....	....	....	....	....	a x
Total by each collector	0	0	0	0	0	0	0	0	0	0	1

a Breeding.

List of species of birds which have been ascertained to occur in the Galapagos Archipelago, showing the islands upon or near which each species has been found.

Names of species.	Narborough.	Albemarle.	Duncan.	Crossman.	Brattle.	Charles.	Hood.	Chatham.	Barrington.	Indefatigable.	Jervis.	James.	Tower.	Bindloe.	Abingdon.	Wenman.
1. Nesomimus trifasciatus (Gould)	....	....	....	....	....	x	....	....	....	....	....	....	....	....	....	....
2. Nesomimus macdonaldi, Ridgway	....	....	....	....	....	....	a x	....	....	....	....	....	....	....	....	....
3. Nesomimus adamsi, Ridgway	....	....	....	....	....	....	....	x	....	....	....	....	....	....	....	....
4. Nesomimus personatus, Ridgway	....	....	....	....	....	....	....	....	....	....	....	....	....	....	x	....
5. Nesomimus melanotis (Gould)	....	....	....	....	....	x!?	....	....	....	x	x	x	....	....	....	....
6. Nesomimus parvulus (Gould)	....	x	....	....	....	....	....	....	....	....	....	....	....	....	....	....
7. Nesomimus bauri, Ridgway	....	....	....	....	....	....	....	....	....	....	....	....	x	....	....	....
8. Nesomimus bindloei, Ridgway	....	....	....	....	....	....	....	....	....	....	....	....	....	x	....	....
—. Nesomimus (undetermined species)	....	....	....	....	....	....	....	....	x	....	....	....	....	....	....	....
9. Dendroica aureola (Gould)	....	x	x	....	....	x	x	x	x	x	x	x	x	x	x	....
10. Certhidea olivacea (Gould)	....	....	....	....	....	....	....	....	....	....	....	x	....	....	....	....
11. Certhidea salvini, Ridgway	....	....	....	....	....	....	....	....	....	x	....	....	....	....	....	....
12. Certhidea albemarlei, Ridgway	....	x	....	....	....	....	....	....	....	....	....	....	....	....	....	....
13. Certhidea luteola, Ridgway	....	....	....	....	....	....	....	x	....	....	....	....	....	....	....	....
14. Certhidea fusca, Sclater and Salvin	....	....	....	....	....	....	....	....	....	....	....	....	....	x?	x	....
15. Certhidea cinerascens, Ridgway	....	....	....	....	....	....	x	....	....	....	....	....	....	....	....	....

a Also Gardner Island, fide G. Baur; but possibly *N. trifasciatus* and not *N. macdonaldi*.

List of species of birds which have been ascertained to occur in the Galapagos Archipelago, showing the islands upon or near which each species has been found—Continued.

Names of species.	Narborough.	Albemarle.	Duncan.	Crossman.	Brattle.	Charles.	Hood.	Chatham.	Barrington.	Indefatigable.	Jervis.	James.	Tower.	Bindloe.	Abingdon.	Wenman.
16. Certhidea mentalis, Ridgway													x			
17 Certhidea bifasciata, Ridgway									x							
—. Certhidea (undetermined)			x								x					
18. Progne modesta (Néboux)						x		x?		x		x				
19. Geospiza magnirostris, Gould		x?				x		x			x?					
20. Geospiza strenua, Gould						x		x		x		x		x	x	
21. Geospiza pachyrhyncha, Ridgway													x			
22. Geospiza dubia, Gould								x								
23. Geospiza conirostris, Ridgway							x									
24. Geospiza bauri, Ridgway												x				
—. Geospiza (undetermined)									x		x					
—. Geospiza (undetermined)											x					
25. Geospiza media, Ridgway							x									
26. Geospiza fortis, Gould		x	x			x				x		x		x		
27. Geospiza fratercula, Ridgway															x	
28. Geospiza fuliginosa, Gould		x	x			x	x	x		x		x			x	
29. Geospiza parvula, Gould								x	x?	x		x		x	x	
30. Geospiza acutirostris, Ridgway													x			
31. Geospiza dentirostris, Gould						x		x?								
32. Geospiza difficilis, Sharpe						x?									x	
33. Geospiza debilirostris, Ridgway												x				
34. Geospiza scandens (Gould)												x				
35. Geospiza intermedia, Ridgway						x										
36. Geospiza assimilis (Gould)												x?		x		
37. Geospiza fatigata, Ridgway		x?						x??		x	x?					
—. Geospiza (undetermined)			x?													
38. Geospiza abingdoni (Sclater and Salvin)															x	
39. Geospiza barringtoni, Ridgway									x							
40. Geospiza brevirostris, Ridgway						x				x?						
41. Geospiza propinqua, Ridgway													x			
42. Camarhynchus variegatus, Sclater and Salvin		x				x		x		x		x		x??	x??	
43. Camarhynchus crassirostris, Gould						x?										
44. Camarhynchus psittaculus, Gould						x?				x	x	x				
45. Camarhynchus affinis, Ridgway		x														
—. Camarhynchus (undetermined)			x?													
46. Camarhynchus habeli, Sclater and Salvin															x	
47. Camarhynchus bindloei, Ridgway														x		
48. Camarhynchus compressirostris, Ridgway											x					
49. Camarhynchus pauper, Ridgway						x										
50. Camarhynchus incertus, Ridgway												x				
51. Camarhynchus salvini, Ridgway								x								
52. Camarhynchus prosthemelas, Sclater and Salvin		x				x				x	x	x				
53. Camarhynchus pallidus (Sclater and Salvin)										x	x	x				
54. Camarhynchus productus, Ridgway		x														
55. Dolichonyx oryzivorus (Linnæus)												x				
56. Myiarchus magnirostris (Gray)		x	x			x	x	x	x	x	x	x		x	x	
57. Pyrocephalus nanus, Gould											x?	x				
58. Pyrocephalus intercedens, Ridgway		x								x						
59. Pyrocephalus carolensis, Ridgway						x										
60. Pyrocephalus abingdoni, Ridgway														x?	x	
61. Pyrocephalus dubius, Gould								x								
—. Pyrocephalus (undetermined)			x													
62. Coccyzus melanocoryphus, Vieillot						x		x								
63. Strix punctatissima										x		x			x	
64. Asio galapagoensis (Gould)		x					x			x		x	x	x		
65. Buteo galapagoensis (Gould)		x	x				x	x	x	x		x		x	x	
66. Fregata aquila								x	x				x	x		
67. Fregata aquila minor (Gmelin)													x			
68. Pelecanus californicus, Ridgway		x				x		x	x					x		
69. Sula cyanops, Sundevall						x							x			
70. Sula nebouxii, Milne-Edwards		x			x	x	x	x	x					x		
71. Sula brewsteri, Goss													x?	ax		
72. Sula piscator (Linnæus)										x			x			x
73. Phaëthon æthereus, Linnæus													x			
74. Ardea herodias, Linnæus?			x							x						
75. Herodias egretta (Gmelin)?		x														
76. Butorides plumbeus (Sundevall)		x	x			x	x	x	x	x		x			x	
77. Nyctanassa violacea (Linnæus) b		x					x	x		x						
78. Phœnicopterus ruber, Linnæus						x				x		x				
79. Pœcilonetta galapagensis, Ridgway		x	x			x	x	x	x	x	x	x	x			

a Also found on Cowley Island by Baur and Adams.
b Also found on Gardner Island by Baur and Adams.

List of species of birds which have been ascertained to occur in the Galapagos Archipelago, showing the islands upon or near which each species has been found—Continued.

Names of species.	Narborough.	Albemarle.	Duncan.	Crossman.	Brattle.	Charles.	Hood.	Chatham.	Barrington.	Indefatigable.	Jervis.	James.	Tower.	Bindloe.	Abingdon.	Wenman.
80. Querquedula versicolor (Vieillot)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
81. Nesopelia galapagoensis (Gould)	...	x	x	...	...	x	x	x	...	x	...	x	x	x	...	...
82. Porzana spilonota (Gould)	...	...	...	...	...	...	...	...	...	x	...	x	...	...	...	...
83. Porzana galapagoensis, Sharpe	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
84. Gallinula galeata (Lichtenstein)	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...
85. Hæmatopus galapagensis, Ridgway	...	x	...	...	...	...	x	x	...	x	...	x	...	x	...	...
86. Arenaria interpres (Linnæus)	...	x	...	...	...	...	x	...	...	x	...	...	...	x	...	...
87. Squatarola squatarola (Linnæus)	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...
88. Ægialitis semipalmata, Bonaparte	...	x	...	...	...	...	...	...	...	x	...	...	...	...	...	...
89. Calidris arenaria (Linnæus)	...	x	...	...	...	...	...	...	...	...	...	...	...	x	...	...
90. Tringa minutilla, Vieillot	...	...	...	...	...	...	...	...	...	x	...	...	...	...	...	...
91. Heteractitis incanus (Gmelin)	...	x	...	...	...	...	x	...	...	x	...	x	...	...	x	...
92. Numenius hudsonicus, Latham	...	x	...	...	...	...	...	x	...	x	...	...	...	...	...	...
93. Numenius borealis (Forster)	...	...	...	...	...	x	...	...	...	...	...	...	...	...	...	...
94. Himantopus mexicanus (Müller)[a]	...	x	...	...	...	...	...	x	...	x	...	x	...	...	...	...
95. Larus fuliginosus, Gould	...	...	...	...	...	x	...	x	x	x	...	x	...	x	x	...
96. Creagrus furcatus (Néboux)	...	...	...	...	x	...	x	x	...	...	...	x	x	...	...	...
97. Anous galapagensis, Sharpe	...	x	...	...	...	x	x	x	...	...	...	...	x	...	...	x
98. Diomedea exulans, Linnæus?	...	...	...	...	...	...	x	...	...	...	...	...	...	...	...	...
99. Diomedea nigripes, Audubon?	...	...	...	...	...	...	x	...	...	...	...	...	...	...	...	...
100. Aestrelata phæopygia, Salvin	...	...	...	...	...	...	...	x	...	x	...	x	...	...	...	...
101. Puffinus subalaris, Townsend	...	...	...	...	...	x?	...	x	...	...	x	...	...	...	...	x
102. Oceanodroma cryptoleucura, Ridgway	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	x
103. Procellaria tethys, Bonaparte	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	x
104. Oceanites gracilis (Elliot)	...	x	...	...	...	...	...	...	...	...	...	x	...	...	...	...
105. Sphenisicus mendiculus, Sundevall	...	x	...	...	...	x	...	...	...	...	...	x	...	...	...	...
Total	0	35	13	0	2	32	21	32	15	36	15	36	17	22	18	5

[a] Also, Kicker Rock, Baur and Adams.

Family MIMIDÆ.

Genus NESOMIMUS, Ridgway.

Nesomimus, RIDGWAY, Proc. U. S. Nat. Mus., XII, No. 767, Feb. 5, 1890, p. 102, footnote. Type, *Orpheus melanotis*, Gould.

Generic characters.—Similar to *Mimus*, Boie, but bill longer and much more compressed basally, and tarsus much longer (nearly twice as long as middle toe instead of only about one-third longer).

Range.—Peculiar to the Galapagos Archipelago.

KEY TO THE SPECIES OF NESOMIMUS

a[1]. Breast crossed by a broken band of dusky spots (sometimes interrupted medially), and chest with a similar but less distinct band (the spots mostly concealed), the two separated by an area of plain white.

b[1]. Larger (wing 4.60–5.05, exposed culmen 1.27–1.35); white tips to lateral rectrices indistinct.

c[1]. Pileum and back blackish brown, with very indistinct grayish edgings. (Charles Island; Gardner Island?) ..... 1. *N. trifasciatus* (p. 483).

c[2]. Pileum and back brownish gray, the feathers with dusky mesial stripes (broader on back). (Hood Island.) ..... 2. *N. macdonaldi* (p. 484).

b[2]. Smaller (wing 4.20–4.50, exposed culmen 0.85–0.95); white tips to lateral rectrices very distinct and more extended. (Chatham Island.) 3. *N. adamsi* (p. 485).

a^2. No markings on breast or chest.

b^1. Darker, with dusky prevailing on upper parts.

c^1. Bill larger, but wing averaging shorter (exposed culmen 0.92–1.07, wing 4.00–4.60). (Abingdon Island)..... 4. *N. personatus* (p. 488).

c^2. Bill smaller and more slender, but wing averaging longer (exposed culmen 0.80–0.87, wing 4.20–4.68). (James, Indefatigable, and Jervis islands)..... 5. *N. melanotis* (p. 489).

b^2. Paler, with grayish brown prevailing on upper parts.

c^1. Bill smaller (exposed culmen 0.72–0.80). (Albemarle Island.)
6. *N. parvulus* (p. 491).

c^2. Bill larger (exposed culmen 0.83–1.00).

d^1. Larger, with shorter tarsus (exposed culmen 0.95–1.00, wing 4.30–4.45, tail 3 95–4.30, tarsus 1.25–1.35. (Tower Island).. 7. *N. bauri* (p. 492).

d^2. Smaller, with longer tarsus (exposed culmen 0.83–0.91, wing 3.85–4.20, tail 3.50–3.90, tarsus 1.32–1.39). (Bindloe Island).
8. *N. bindloei* (p. 492).

I am aware of the unsatisfactory nature of the above key, which is owing in large measure to the fact that in some cases the specimens upon which it is based (Dr. Baur's specimens having previously been returned to him) are in a state of plumage different from that of specimens of the allied species, rendering exact comparison impossible.

The species of this genus fall into two groups, which in a more exact sense might be considered as species, the several allied forms being more properly subspecies or local races. Thus *N. trifasciatus*, *N. macdonaldi*, and *N. adamsi*, with their double breastbands, represent one type, while *N. melanotis*, *N. parvulus*, *N. personatus*, *N. bauri*, and *N. bindloei* represent another. Were these forms of continental habitat, where there was every probability or even certainty of intergradation, I should consider them subspecies and give them trinomial instead of binomial names (for example, *Nesomimus trifasciatus macdonaldi*, *Nesomimus trifasciatus adamsi*, *Nesomimus melanotis personatus*, *Nesomimus melanotis parvulus*, *Nesomimus melanotis bauri*, and *Nesomimus melanotis bindloei*). But the case of insular forms is different, intergradation in the same sense being impossible, and therefore, notwithstanding the slight differences they present, I prefer to consider the several forms as if they were distinct species.

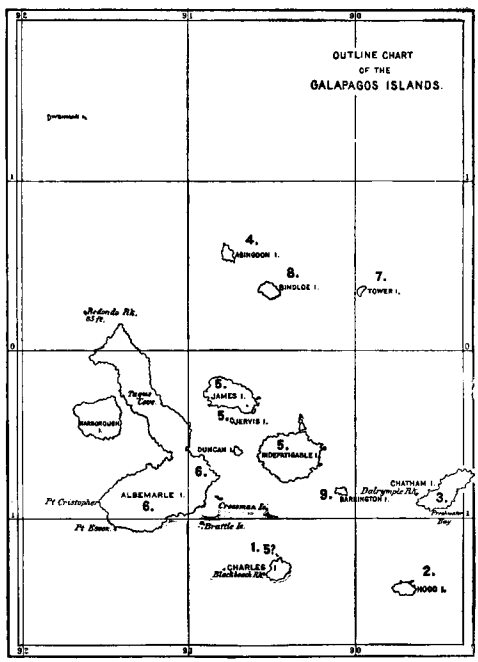
The genus *Nesomimus* occurs at present, or rather as recently as Messrs. Baur and Adams' visit (1891), on all the larger islands of the Galapagos Archipelago, except Narborough, Duncan, and Charles. It was formerly represented on the last-named by a peculiar species (*N. trifasciatus*, closely related to *N. macdonaldi* of Hood Island), which seems to have, like *Geospiza magnirostris* of the same island, become extinct there.[1] The genus was also found by Messrs. Baur and Adams to be

[1]Messrs. Baur and Adams collected a *Nesomimus* on Gardner Island, which they identified as *N. macdonaldi*, the Hood Island form; but as Gardner Island is much closer to Charles than to Hood Island it is possible the species was *N. trifasciatus*. Unfortunately the specimens were lost, and the form must therefore remain in doubt until more can be procured.

absent from the northern part of Chatham Island, though observed and collected by them in the southern portion.

In addition to the islands inhabited by an identified species, there are two which possess, or formerly possessed, forms not satisfactorily determined. These are Barrington Island, upon which a *Nesomimus* was found to be common by Messrs. Baur and Adams—but their speci-

ASCERTAINED RANGE OF THE GENUS NESOMIMUS, RIDGWAY.



1. *Nesomimus trifasciatus* (Gould).
2. *Nesomimus macdonaldi*, Ridgway.
3. *Nesomimus adamsi*, Ridgway.
4. *Nesomimus personatus*, Ridgway.
5. *Nesomimus melanotis* (Gould).
6. *Nesomimus parvulus* (Gould).
7. *Nesomimus bauri*, Ridgway.
8. *Nesomimus bindloei*, Ridgway.
9. (Undetermined form.)

mens having been lost, the species is unknown—and Charles Island, upon which Darwin found *N. trifasciatus* and Kinberg what Professor Sundevall identified as *N. melanotis*. Dr. Baur informs me that not a single specimen of *Nesomimus* could be discovered by Mr. Adams and himself on Charles Island; so it would seem that those which formerly inhabited that island had become extinct.

NESOMIMUS TRIFASCIATUS (Gould).

Orpheus trifasciatus, GOULD, Proc. Zool. Soc., 1837, p. 27 (no locality; coll. J. Gould).

Mimus trifasciatus, GRAY, Zool. Voy. Beag., III, Birds, 1841, p. 62, pl. XVI (Charles Island).—BONAPARTE, Consp. Av., I, 1850, p. 277.—SCLATER, Proc. Zool. Soc., 1859, p. 345.—SUNDEVALL, Proc. Zool. Soc., 1871, p. 127.—SCLATER and SALVIN, Nom. Av. Neotr., 1873, p. 3.—SALVIN, Trans Zool. Soc., IX, Pt. IX, 1876, p. 471.—SHARPE, Cat. Birds Brit. Mus., VI, 1881, p. 346.

Specific characters.—Similar to *N. macdonaldi*, Ridgway, of Hood Island, but pileum and back blackish brown with indistinct grayish edgings.

Range.—Galapagos Archipelago: Charles Island (Darwin). [Extinct?.]

"*Adult.*—General color above blackish brown, the feathers mottled with obsolete ashy markings on the back, a little plainer on the head, the lower back, and rump, the latter ashy brown, mottled with dark brown centers to the feathers; least wing-coverts blackish brown, edged with ashy whitish; median and greater series blackish, tipped with white and margined with ashy brown; bastard wing-feathers and primary coverts blackish brown, edged with ashy brown and narrowly tipped with white; quills blackish brown, the secondaries margined with pale reddish brown and tipped with white, the primaries edged with ashy whitish; upper tail-coverts light brown with ashy-whitish margins; tail-feathers dark brown, all but the center ones lighter brown at the tip, the outer ones whitish at the end of either web; lores dusky blackish; over the eye a distinct white stripe; sides of face and ear-coverts whitish, mottled below the eye and on the fore part of the ear coverts with dusky blackish tips to the feathers; cheeks and throat and fore neck white, with a slight mustache of dusky blackish; remainder of under surface of body white, the sides spotted with blackish brown in the form of longitudinal drops; across the chest a band of blackish-brown feathers tipped with white; thighs brown, some of the inner feathers tipped with white; under tail-coverts white, with dusky bases; under wing-coverts and axillaries dark brown, edged with dull white; quills dusky brown, with ashy-fulvous margins to the inner web. Total length, 9.5 inches; culmen, 1.3; wing, 5; tail, 4.2; tarsus, 1.7.

"The second specimen in the Museum has the chest-band much less developed than in the one described, it being composed of blackish-brown bars instead of forming a broad band across." (Sharpe.)

No specimens of this form have been collected by any one since Darwin's visit to the Galapagos, and the two examples in the British Museum (the one described by Dr. Sharpe being the type) appear to be the only ones extant. It may possibly still exist upon some island from which no specimens have been secured; but no species of the genus was found on Charles Island by either Mr. Townsend or Messrs. Baur and Adams, and it is not at all unlikely *N. trifasciatus* may be extinct.

Messrs. Baur and Adams obtained a *Nesomimus* on Gardner Island, which lies between Charles and Hood islands, which Dr. Baur thought to be the same as the Hood Island form (*N. macdonaldi*); but as Gardner Island lies very close to Charles, it seems more likely to have been *N. trifasciatus*. Dr. Baur's specimens having been lost, the question remains to be decided.

NESOMIMUS MACDONALDI, Ridgway.

(Plate LVI, fig. 6.)

Nesomimus macdonaldi, RIDGWAY, Proc. U. S. Nat. Mus., XII, No. 767, Feb. 5, 1890, p. 103, fig. 1 (Hood Island, Galapagos; U. S. Nat. Mus.).

Specific characters.—Similar to *N. trifasciatus* (Gould), but much grayer above, much more black on side of head, the bill much longer, and the tarsi much shorter.

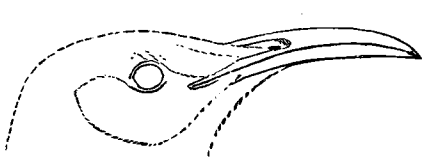


FIG. 1. *Head of Nesomimus macdonaldi.*

Range.—Galapagos Archipelago: Hood Island (Townsend, Baur and Adams); ? Gardner Island (Baur and Adams.[1])

Adult male.—(Type, No. 116066, U.S.N.M.; Hood Island, Galapagos, April 7, 1888; U. S. S. *Albatross.*) Above brownish gray, more ashy anteriorly and on lesser wing-coverts, becoming decidedly brown on rump, each feather with a central or mesial space of dusky, these markings largest on back and scapulars, nearly obsolete on lower back and hind neck; wings (except lesser coverts) dull black, the posterior row of lesser coverts, middle coverts, and greater coverts broadly margined at tips with white, forming three bands across the wing; greater coverts and tertials broadly edged with drab or grayish brown, the latter margined terminally with white; primaries and their coverts narrowly edged with pale brownish gray or dull whitish; tail blackish dusky, the outer feather with an ill-defined pale brownish-gray space near tip of inner web, next to edge, the second with a mere edging of the same color in corresponding position. A narrow and poorly defined superciliary stripe of white, bordered beneath by a blackish stripe covering lores, extending beneath eye, and thence along upper edge of auricular region, the rest of the latter dull light gray mixed with black, especially on lower posterior portion; a broad white malar stripe, bordered beneath by a narrow interrupted stripe of dusky along each side of throat. Under parts white, tinged with pale drab across chest, where

[1] The specimens collected were lost. Gardner Island being nearer to Charles than to Hood, the species may have been *N. trifasciatus*.

sparsely spotted with brownish dusky; upper part of breast immaculate, forming a rather distinct broad band or belt, this succeeded by broad lateral patches (nearly or quite meeting on middle of breast) where the feathers are faintly tinged with brownish gray and marked with large central, more or less U-shaped spots of dusky; sides and flanks broadly streaked with dusky. Bill black, slightly brownish on basal portion of lower mandible; legs and feet brownish black. Length (skin), 10.50; wing, 4.90; tail, 4.48 (middle feathers not grown out); exposed culmen, 1.25; bill to rictus, 1.60; tarsus, 1.55; middle toe, 0.90.

Adult female.—(No. 116064 U.S.N.M.; Hood Island, Galapagos, April 7, 1888.) Similar to the male described above, but slightly smaller, bill straighter, and under parts more tinged with brown, as well as more distinctly spotted across chest. Length (skin), 10; wing, 4.55; tail, 4; exposed culmen, 1.25; bill to rictus, 1.58; tarsus, 1.49; middle toe, 0.88.

Four additional adult males agree essentially in coloration with the one described, and measure as follows: Length (skin), 10–10.50; wing, 4.60–5.05; tail, 4.40–4.60; exposed culmen, 1.27–1.35; bill to rictus, 1.55–1.65; tarsus, 1.50–1.53; middle toe, 0.88–0.93.

This fine new species is named after the late Colonel Marshall McDonald, United States Commissioner of Fish and Fisheries.

The collection of Messrs. Baur and Adams contains one example of this species from Hood Island.

Measurements of Nesomimus macdonaldi.

No.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
116063	U.S.	Adult male	Hood Island	Apr. 7, 1888	4.95	(4.30)	1.30	1.50	0.91
116064	U.S.	Adult female	do	do	4.50	(4.00)	1.24	1.50	0.88
116065	U.S.	Adult male	do	do	(4.50)	(4.08)	1.25	1.50	0.92
116066	U.S.	do	do	do	4.93	4.50	1.28	1.52	0.90
116067	U.S.	do	do	do	5.00	(4.12)	1.22	1.50	0.90
149823	U.S.	do	do	do	.....	.....	1.28	1.51	0.91
149824	U.S.	do	do	do	4.85	(4.28)	1.23	1.52	0.91
149825	U.S.	Adult	do	do	(4.32)	(4.00)	1.21	1.45	0.85
149846	U.S.	do	do	do	4.50	4.20	1.20	1.50	0.90
			Average		4.79	4.19	1.25	1.50	0.90

NESOMIMUS ADAMSI, Ridgway.

(Plate LVI, fig. 2.)

Mimus melanotis (part), GOULD, Zool. Voy. Beagle, III, Birds, 1841, p. 62 (Chatham Island).—SUNDEVALL, Proc. Zool. Soc., 1871, p. 124 (Chatham Island).

Nesomimus melanotis (part), RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 102 (Chatham Island).

Nesomimus adamsi, RIDGWAY, Proc. U. S. Nat. Mus., XVII (Nov. 15, 1894)[1], p. 358 (Chatham Island, Galapagos Archipelago; collection of Dr. G. Baur).

Specific characters.—Similar to *N. macdonaldi*, Ridgway, in color, but very much smaller, and differing in some respects as to coloration.

Range.—Galapagos Archipelago: Chatham Island (Darwin, Kinberg, Townsend, Baur and Adams).

[1] Author's edition of separates.

Adult male.—Type, collection Dr. G. Baur; Chatham Island, June 13, 1891. Above brownish gray changing to light brown on the rump; top of head marked with distinct mesial streaks of black (proportionally narrower than those of *N. macdonaldi*) and back with broad mesial spots of dusky (much less intense than those of *N. macdonaldi*); rump and upper tail-coverts (the latter grayish, like back, etc.) with streaks indistinct and mostly concealed; lesser wing-coverts light brownish gray with dusky central spots (mostly concealed); rest of wings dusky, the middle coverts with broad terminal margins of grayish white, slightly tinged with buff; greater coverts broadly tipped and edged with the same, the edgings more buffy, the tips purer white; secondaries broadly edged with light buffy brown passing into buffy white on terminal margins; primaries, primary coverts, and alula very narrowly edged with grayish white and with broader terminal margins of purer white; tail nearly black, becoming brownish slaty basally, the feathers indistinctly but rather broadly edged with brownish gray; outermost feather edged with white, and with a large white space (about 0.85 long) terminating the inner web; next feather with the white space about 0.80 long, the next with it about 0.60, and so on, decreasing in size and distinctness of definition to the fifth, where it forms a narrow mark along the edge of the inner web near tip. A rather indistinct superciliary stripe of dull grayish white; lores, suborbital region, and ear-coverts blackish, the last streaked with light brownish gray. Under parts, including malar region, buffy white; along each side of throat a narrow streak of dusky; chest faintly shaded with grayish, forming an indistinct broad band, within which many of the feathers have a small dark brownish gray cordate central spot; sides of breast similarly colored, forming two lateral patches nearly meeting on the median line, but the dark spots larger and more distinct; sides and flanks with broad longitudinal streaks of dusky, most intense on flanks. Bill brownish black, becoming pale brownish on basal third of mandible; legs and feet black; "iris dull yellow." Length (skin), 8.60; wing, 4.40; tail, 3.90; exposed culmen, 0.87; bill to rictus, 1.25; tarsus, 1.50; middle toe, 0.83.

Young.—No. 115933, U.S.N.M.; Chatham Island, April 5, 1888; C. H. Townsend. Forehead and crown dark brownish gray, uniform anteriorly but posteriorly streaked with pale brownish gray, the feathers of the hinder crown and occiput being this color, with broad, dusky grayish mesial streaks; nape and hind neck very pale brownish gray, indistinctly mottled with darker tips to the feathers; back and scapulars buffy brown with large central longitudinal spots of dusky; lower back and rump buffy cinnamon, broadly but indistinctly streaked with dusky toward upper tail-coverts, the latter nearly uniform grayish tinged with cinnamon on edges; wings dusky (nearly black on remiges); lesser coverts broadly margined with buffy brownish gray; middle coverts broadly tipped with pale buff; greater coverts broadly tipped with pale buff and broadly edged with deep buff; secondaries broadly margined

with cinnamon-buff, paler at tips; primaries, primary coverts, and alulæ edged with dull whitish. Tail as in adult. Under parts dull white, the chest marked with distinct blackish spots (larger and more round centrally, smaller and more angular or sagittate laterally); sides and flanks broadly streaked with dusky grayish. An indistinct superciliary stripe of grayish white; lores and suborbital region dusky mixed with grayish; ear-coverts dusky grayish, paler centrally, the feathers with dull whitish shaft streaks.

This very distinct species, while about the size of *N. melanotis*, clearly belongs to the same group as *N. trifasciatus* and *N. macdonaldi*, having the same brownish gray band across the chest and broken belt of dusky spots across the lower breast. The ear-coverts are more extensively and solidly black than in the larger species, nearly as much so as in *N. melanotis*, which perhaps has caused it to be referred to the latter. The white tips to the outer rectrices are much more extensive and more abruptly defined than in *N. macdonaldi*, being very much as in *N. melanotis*.

Compared with 16 specimens of *N. melanotis* from James Island, the 11 adults of the present species from Chatham Island differ in the much lighter color of the pileum, the ground color of which is brownish gray relieved by mesial streaks of blackish, which never, at any season, equal the gray in extent; the feathers of the dorsal region are much more broadly edged with gray, and the lower parts are markedly different, as described above.

The young of *N. adamsi* may at once be distinguished from that of *N. melanotis* by its much paler coloration above, and much more distinctly as well as extensively cinnamomeous rump, the entire pileum of the young *N. melanotis* (of which two are before me) being nearly uniform sooty blackish, whereas the young *N. adamsi* described above is the darkest crowned of five examples.

The failure of previous authors to distinguish this species from *N. melanotis* is doubtless due to the circumstance that their specimens were in such badly worn plumage that the differential characters were not apparent; certainly this was the case with those examined by Professor Sundevall, and also with the series collected by Mr. Townsend. Dr. Habel, whose collection formed the basis of Mr. Salvin's monograph, did not obtain it.

Measurements of Nesomimus adamsi.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
52409	U. S.	Adult	Chatham Island		4.43	(4.00)	0.90	1.47	0.85
125889	U. S.	Adult male	do	Mar. 30, 1891	4.55	4.12	.95	1.50	.85
125890	U. S.	Adult female	do	do	4.20	3.62	.85	1.50	.82
125891	U. S.	Adult male	do	do	4.32	3.75	.92	1.50	.87
125893	U. S.	Adult	do	do	4.30	3.90	.97	1.50	.86
			Average		4.36	3.85	.92	1.49	.85

NESOMIMUS PERSONATUS, Ridgway.

(Plate LVI, fig. 5.)

Nesomimus personatus, RIDGWAY, Proc. U. S. Nat. Mus., XII, No. 767, Feb. 5, 1890, p. 104 (Abingdon Island, Galapagos; collection U. S. Nat. Mus.).

Specific characters.—Similar to *N. melanotis* (Gould), but much larger and darker, with sides and flanks more tinged with brown.

Range.—Galapagos Archipelago: Abingdon Island (Townsend).

Adult male.—Type, No. 116098, U.S.N.M.; Abingdon Island, Galapagos, April 16, 1888; U. S. S. *Albatross.* Pileum, hind neck, back, scapulars, wings, and tail[1] dull blackish, the feathers indistinctly margined or edged with dull grayish brown, these edgings much wider and more distinct on wing- and tail-feathers; feathers of hind neck ash-gray beneath the surface; lower back, rump, and upper tail-coverts dull grayish brown, the feathers darker centrally, forming indistinct streaks; middle and greater wing-coverts broadly tipped with dull white, forming two distinct bands across wing; remiges rather broadly margined at tips with dull light brownish gray (more brownish on tertials); three outer tail-feathers broadly tipped with pale grayish brown (fading into dull white exteriorly), this color confined to the inner web on third feather; fourth feather with a more restricted and less definite lighter terminal space, and two middle pairs merely fading at tips into dull grayish brown edged with dull whitish. A superciliary stripe of dull grayish white, narrower, whiter, and more sharply defined over lores; lores, suborbital region, and auriculars dull black, forming a conspicuous patch along side of head; malar region, sides of neck, and lower parts white, the first speckled with dusky, the second spotted with same posteriorly, and the latter tinged with light brownish, except on chin and throat, the sides and flanks very distinctly washed or suffused with brown, the latter broadly streaked or striped with dusky. Bill black, inclining to horn color at tip of upper and base of lower mandible; legs and feet brownish black. Length (skin), 9.30; wing, 4.50; tail, 4.15; exposed culmen, 1; bill from rictus, 1.35; tarsus, 1.13; middle toe, 0.87.

Adult female.—No. 116099, U.S.N.M.; same locality, etc. Essentially like the male in coloration, but smaller. Length (skin), 9; wing, 4.10; tail (feathers much worn), 3.90; exposed culmen, 1.07; bill from rictus, 1.40; tarsus, 1.35; middle toe, 0.80.

Six additional adult males agree in all essential characters with the type.

[1]The specimen was molting when shot, though the new plumage had been mostly assumed; consequently, in this description, the duller, faded coloration of the old feathers is ignored.

Measurements of Mimus personatus.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
116094	U. S.	Adult male	Abingdon Island	Apr. 16, 1888	4.37	(3.82)	0.98	1.40	0.90
116095	U. S.	do	do	do	4.28	3.91	.98	1.45	.87
116096	U. S.	do	do	do	4.45	3.98	1.00	1.45	.87
116097	U. S.	do	do	do	4.48	4.07	1.00	1.48	.88
116098	U. S.	do	do	do	4.55	4.10	.98	1.45	.87
135666	U. S.	do	do	do	4.37	4.10	.98	1.43	.88
135667	U. S.	do	do	do	4.35	4.12	1.07	1.43	.85
135668	U. S.	do	do	do	4.45	4.00	1.00	1.50	.90
135670	U. S.	do	do	do	4.40	4.00	.98	1.42	.88
135671	U. S.	do	do	do	4.20	3.82	.95	1.43	.85
135672	U. S.	do	do	do	4.28	.....	.90	1.50	.87
			Average		4.38	4.01	.98	1.45	.87
116099	U. S.	Adult female	Abingdon Island	Apr. 16, 1888	4.12	3.78	1.09	1.38	.80
135674	U. S.	do	do	do	4.15	.....	1.00	1.33	.82
135675	U. S.	do	do	do	4.12	3.73	.98	1.38	.....
			Average		4.13	3.76	.99	1.36	.81

NESOMIMUS MELANOTIS (Gould).

(Plate LVI, fig. 2.)

Orpheus melanotis, GOULD, Proc. Zool. Soc., 1837, p. 27 (no locality; coll. J. Gould).

Mimus melanotis, GOULD, Zool. Voy. Beagle, III, Birds, 1841, p. 62, pl. XVII ("Chatham and James islands," Galapagos Archipelago).—SCLATER, Proc. Zool. Soc., 1859, p. 345.—SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (part: James and Indefatigable islands); Nom. Av. Neotr., 1873, p. 3.—SUNDEVALL, Proc. Zool. Soc., 1871, pp. 124, 126 (part: Charles, James, and Indefatigable islands).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 471 (Charles, James, and Indefatigable islands).—SHARPE, Cat. Birds Brit. Mus., VI, 1881, p. 349.

Nesomimus melanotis (part), RIDGWAY, Proc. U. S. Nat. Mus., XII, 1890, p. 102 (James and Indefatigable islands).

Specific characters.—Similar to *N. personatus*, Ridgway, of Abingdon Island, but much smaller, the bill especially; colors paler, with the flanks less strongly tinged with brown.

Range.—Galapagos Archipelago: ?? Charles Island (Kinberg); Indefatigable Island (Habel, Kinberg, *Albatross*, Baur and Adams); Jervis Island (Baur and Adams); James Island (Darwin, Kinberg, Townsend, Baur and Adams).

Adult female.[1]—No. 115990, U.S.N.M.; James Island, April 11, 1888; C. H. Townsend. Entire pileum sooty blackish, the feathers narrowly margined with brownish gray, producing a scaled appearance; hind neck light brownish gray—almost grayish white, longitudinally spotted with sooty black, producing a conspicuous collar; back and scapulars sooty blackish, the feathers indistinctly margined with dull brownish gray; lower back and rump light buffy brownish, almost uniform; upper tail-coverts brownish gray. Wings dusky black; lesser coverts broadly margined with brownish gray; middle coverts broadly

[1] There is no adult male in good plumage available for description.

tipped with dull white; greater coverts broadly tipped with dull buffy white and edged with light grayish brown; secondaries edged with light grayish brown, more whitish terminally, the tertials with broader, browner edgings which terminate in still broader dull whitish tips; primaries, primary coverts, and alula not distinctly edged with paler except at tips. Tail dusky blackish, the feathers edged with dull brownish gray; outermost feather with a terminal spot of pale brownish gray passing into white at tip, this much broadest (0.07 of an inch next to shaft) on inner web; these light-colored tips gradually diminish in size to the middle pair of rectrices, which have merely a narrow terminal margin of brownish gray. A distinct superciliary stripe of dull grayish white extending from bill to occiput; a whitish crescent immediately beneath eye; lores and entire auricular region uniform sooty blackish, connected by a narrow band beneath the suborbital whitish crescent. Malar region, sides of neck, and entire under parts white, the first minutely speckled posteriorly with dusky; sides and flanks slightly tinged with buff and broadly streaked with dusky. Bill black, paler at base of mandible; legs and feet black. Length (skin), 9.20; wing, 4.10; tail, 3.95; exposed culmen, 0.88; bill to rictus, 1.08; tarsus, 1.40; middle toe, 0.80.

Young male.—No. 115991, U.S.N.M.; James Island, April 11, 1888; C. H. Townsend. Similar to the adult, as described above, but chest and upper breast thickly marked with triangular spots of grayish dusky; feathers of pileum without grayish margins, except on forehead, and there indistinct; superciliary stripe less distinct, and dusky band on side of head (from lores to auriculars, inclusive) less black, with the center of the auricular region mostly light grayish; wing-markings more tinged with buff, especially tips of greater coverts; rump and upper tail-coverts more obviously streaked.

Adults in worn plumage are much more uniform above, the lighter margins to the feathers of the pileum and dorsal region having disappeared while the broad whitish collar across the hind neck is unbroken by dusky spotting.

Owing to the circumstance that so few of the specimens are in good plumage, it is impossible to make satisfactory comparison between specimens from the different islands. Those from Jervis Island (in Dr. Baur's collection) appear, however, to be rather browner (some of them conspicuously so) than those from James and Indefatigable.

Dr. Baur's collection contained specimens from James (8), Indefatigable (5), and Jervis (5).

I have not seen specimens from Charles Island, and doubt the correct identification of the so-called *N. melanotis* from that locality.

Measurements of Nesomimus melanotis.

Number.	Collection.	Sex and age.	Locality.	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
115986	U. S. N. M.	Adult male	James Island, Galapagos.	4.55	4.30	0.90	1.45	0.77
115983	U. S. N. M.	do	do	4.65	4.40	.87	1.50	.85
115987	U. S. N. M.	Adult	do	4.35	4.20	.82	1.45	.78
115985	U. S. N. M.	Adult female	do	4.05	3.80	.85	1.40	.78
115989	U. S. N. M.	do	do	4.20	4.08	.82	1.35	.78
115984	U. S. N. M.	do	do	4.18	3.90	.87	1.42	.85
115990	U. S. N. M.	do	do	4.10	3.95	.88	1.40	.80
			Average	4.29	4.09	.86	1.42	.80
116036	U. S. N. M.	do	Indefatigable Island	4.28	4.12	.78	1.42	.82
125888	U. S. N. M.	do	do	4.30	4.05	.85	1.45	.82
116034	U. S. N. M.	Adult	do	4.48	4.20	.82	1.40	.78
116035	U. S. N. M.	Adult male	do	4.52	4.22	.90	1.50	.80
			Average	4.40	4.15	.84	1.44	.81

NESOMIMUS PARVULUS (Gould).

(Plate LVI, fig. 1.)

Orpheus parvulus, GOULD, Proc. Zool. Soc., 1837, p. 27 (no locality; coll. J. Gould).

Mimus parvulus, GRAY, Zool. Voy. Beagle, III, Birds, 1841, p. 63, pl. XVIII (Albemarle Island, Galapagos Archipelago).—BONAPARTE, Consp. Av., I, 1850, p. 277.—SCLATER, Proc. Zool. Soc., 1859, p. 345.—SUNDEVALL, Proc. Zool. Soc., 1871, p. 127.—SCLATER and SALVIN, Nom. Av. Neotr., 1873, p. 3.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 472.—SHARPE, Proc. Zool. Soc., 1877, p. 65; Cat. Birds Brit. Mus., VI, 1881, p. 350.

Nesomimus parvulus, RIDGWAY, Proc. U. S. Nat. Mus., XII, 1890, p. 104.

Specific characters.—Similar to *N. melanotis* (Gould), but considerably smaller, bill less curved, sides of head less dark, and general coloration of upper parts paler; in worn breeding plumage a distinct brownish gray shade across the upper breast, not noticeable in *N. melanotis*.

Range.—Galapagos Archipelago: Albemarle Island (Darwin, Townsend, Baur and Adams).

Adult.[1]—"The vertex, the nape of the neck, and the tail intensely black, with the tips of the tail-feathers marked with white; the wings brown with the secondaries and coverts tipped with white marks, giving the appearance of two transverse bands; the lores and the feathers of the ears black; the throat, the sides of the neck, breast, and the abdomen white; the flanks marked longitudinally with brown."[2]

Six adult examples in fresh plumage in Messrs. Baur and Adams' collection (4 from Albemarle, 2 from East Albemarle) show that the supposed more grayish breast of *N. parvulus*, to which I have called attention,[3] is a character which can not be relied on in all conditions of

[1] In the absence of any adult specimen in good plumage, I am obliged to quote Gould's description. Dr. Baur's collection contained six examples in fresh plumage, but they were returned without a description having been taken.

[2] Gould, Zool. Voy. Beagle, III, Birds, p. 63.

[3] Proc. U. S. Nat. Mus., XII, pp. 102, 103.

plumage. In fact, when examining Dr. Baur's specimens and comparing them with examples of *N. melanotis* in corresponding condition, the smaller size, especially of the bill, of *N. parvulus* seemed to be the only positively distinctive character, apart from a general lighter coloration of the upper parts and sides of the head.

The two adults in the National Museum collection measure as follows: Wing, 4.30–4.35; tail, 4.05–4.35; exposed culmen, 0.75; tarsus, 1.45; middle toe, 0.81.

A young bird, in first plumage, I can distinguish from the young of *N. melanotis* only by its smaller and straighter bill.

Measurements of Nesomimus parvulus.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
115972	U. S.	Male adult.	Albemarle Island ..	Apr. 10, 1888	4.20	4.05	0.76	1.47	0.80
115973	U. S.	....do	.....do.....	....do	4.40	4.38	.79	1.45	.80
			Average.....	.....	4.30	4.22	.78	1.46	.80

NESOMIMUS BAURI, Ridgway.

(Plate LVI, fig. 4.)

Nesomimus bauri, RIDGWAY, Proc. U. S. Nat. Mus., XVII (No. 1007, Nov. 15, 1894), p. 357 (Tower Island, Galapagos Archipelago; collection of Dr. G. Baur).

Specific characters.—Similar to *N. personatus*, Ridgway, of Abingdon Island, but much lighter colored above. Dimensions averaging less, and flanks more narrowly streaked with dusky. Wing, 4.30–4.45; tail, 3.95–4.30; exposed culmen, 0.95–1; bill from rictus, 1.25–1.27; tarsus, 1.25–1.35; middle toe, 0.78–0.85. (Type in Dr. Baur's collection, September 2, 1891.)

Range.—Galapagos Archipelago: Tower Island (Baur and Adams).

In coloration of the upper parts this form resembles *N. melanotis* much more than *N. personatus;* otherwise, however, it is easily distinguished, the bill being much larger (sometimes quite as large as in smaller billed examples of *N. personatus*), the light-colored tips to middle wing-coverts much wider, white terminal spots of rectrices smaller and differently shaped, and dusky streaks much narrower.

Three specimens are in Dr. Baur's collection.

NESOMIMUS BINDLOEI, Ridgway.

Nesomimus bindloei, RIDGWAY, Proc. U. S. Nat. Mus., XVII, (No. 1007, Nov. 15, 1894), p. 358 (Bindloe Island, Galapagos; collection of Dr. G. Baur).

Specific characters.—Similar to *N. bauri*, Ridgway, but smaller and with proportionally longer tarsus; ear-coverts solidly black, tips to lesser wing-coverts paler (usually nearly white on posterior row), and

white on rectrices more extended. Wing, 3.85–4.20; tail, 3.50–3.90; exposed culmen, 0.83–0.91; bill from rictus, 1.15–1.20; tarsus, 1.32–1.39; middle toe, 0.75–0.81. (Type in Dr. Baur's collection.)

Range.—Galapagos Archipelago: Bindloe Island (Baur and Adams.)

Five specimens, all separable from *N. bauri* by the above-mentioned characters.

Family MNIOTILTIDÆ.

Genus DENDROICA, Gray.

Dendroica, GRAY, List Gen. B. App., III, 1842, p. 8. Type, *Motacilla coronata*, Linnæus.

Range.—North and Middle America, and extreme northern part of South America; Galapagos Archipelago (one species only, closely related to West Indian forms).

According to Dr. Baur, the Galapagoan species, *D. aureola* (Gould), occurs on all the islands of the group.

DENDROICA AUREOLA (Gould).

Sylvicola aureola, GOULD, Zool. Voy. Beagle, III, Birds, 1841, p. 86, pl. XXVIII (Galapagos Archipelago).—BONAPARTE, Consp. Av., I, 1850, p. 309.

Dendroica aureola, CASSIN, Proc. Acad. Nat. Sci. Phila., 1860, p. 192.—BAIRD, Review, I, 1864, p. 194.—BAIRD, BREWER, and RIDGWAY, Hist. N. Amer. Birds, I, 1874, p. 217.—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, pp. 105, 119, 121–126 (Indefatigable, Charles, James, and Chatham islands).—TOWNSEND, Bull. Mus. Comp. Zool., XXVII, No. 3, 1895, p. 122 (Cocos Island).

Dendroica aureola, SCLATER and SALVIN, Proc. Zool. Soc. 1870, p. 323 (Indefatigable, Bindloe, and Abingdon islands); Nom. Av. Neotr., 1873, p. 9.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 473 (Indefatigable, Bindloe, and Abingdon islands); Proc. Zool. Soc., 1883, p. 420 (Charles Island).—SHARPE, Proc. Zool. Soc., 1877, p. 66 (Charles Island); Cat. Birds Brit. Mus.; X, 1885, p. 282 (Indefatigable, Charles, and Abingdon islands; Gorgona Island, Panama Bay; Ecuador; Peru).—TACZANOWSKI, Orn. du Pérou, I, 1884, p. 467 (Sta. Lucia and Tumbez, w. Peru).

Dendroica petechia, L., var., SUNDEVALL, Proc. Zool. Soc. 1871, p. 124 (Chatham, Charles, and James islands).

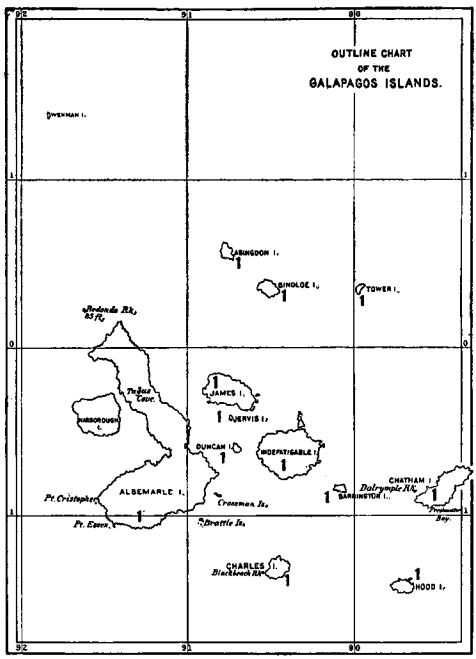
Specific characters.—Very similar to *D. petechia* (Linnæus), but adult male with pileum more extensively and intensely orange-rufous. In other stages not with certainty distinguishable from *D. petechia* (?).

Range.—Galapagos Archipelago: Albemarle Island (Habel, Baur and Adams); Duncan Island (Baur and Adams); Charles Island (Darwin ?, Kinberg, Cookson, *Albatross*); Hood Island (Habel, Baur and Adams); Chatham Island (Darwin ?, Kinberg, Jones, *Albatross*, Baur and Adams); Barrington Island (Baur and Adams); Indefatigable Island, (Habel, *Albatross*, Baur and Adams); Jervis Island (Baur and Adams); James Island (Darwin ?, Kinberg, *Albatross*, Baur and Adams); Tower Island (Baur and Adams); Bindloe Island (Darwin ?, Habel); Abingdon Island (Habel). Cocos Island (Townsend). Gorgona Island, Bay of

Panama (Kellett and Wood). Western Ecuador: Guayaquil (Baur and Adams). Western Peru: Santa Lucia (Stolzmann); Tumbez (Raimondi).

Adult male.—No. 81788, U.S.N.M.; Abingdon Island, Galapagos, April, 1879, Dr. A. Habel. Pileum light chestnut, the feathers clear lemon yellow basally; rest of upper parts yellowish olive green, paler and more grayish on rump and upper tail-coverts; wing-coverts (except lesser) and remiges dusky blackish, the middle and greater coverts and

ASCERTAINED RANGE OF THE GENUS DENDROICA, GRAY, IN THE GALAPAGOS ARCHIPELAGO.



1. *Dendroica aureola* (Gould).

tertials broadly margined with canary yellow, the greater coverts so broadly edged with this color as almost to form a solid patch on the closed wing; secondaries and three or four outermost primaries narrowly edged with olive-yellow, the remaining primaries and primary coverts with yellowish olive-gray. Inner webs of rectrices pale canary yellow, except for terminal portion, which is dusky; the yellow on three outermost feathers occupying full width of the web, while the fourth and fifth have a stripe of dusky next the shaft (widest on fifth),

both webs of the middle pair being dusky; outer webs of all the rectrices edged with light olive-green. Whole side of head (including superciliary region) and entire under parts rich yellow, becoming paler (canary yellow) posteriorly, on under wing-coverts and edges (broadly) of inner webs of remiges; chest and sides of breast marked with broad streaks (more or less cuneate or sagittate anteriorly) of rather light orange-chestnut, the sides and flanks with still narrower and paler streaks of the same. Bill blackish (in dried skin) with paler tomia; legs and feet brownish.[1] Length (skin), 4.70; wing, 2.55; tail (much worn), 2; exposed culmen, 0.48; tarsus, 0.85; middle toe, 0.48.

Adult female.—No. 125901, U.S.N.M.; Chatham Island, March 30, 1891, C. H. Townsend. Altogether duller colored than the adult male. Above plain olive-green, becoming more yellowish on forehead; wings and tail as in adult male, but dusky color not so dark, and yellow edgings, etc., rather less sharply contrasted; superciliary stripe (wider and clearer in color on sides of forehead) and entire under parts clear yellow, rather less intense than in adult male, the under parts without trace of orange-chestnut streaks. Length (skin), 4.90; wing, 2.38; tail, 1.80; exposed culmen, 0.42; tarsus, 0.80; middle toe, 0.45.

Young (male?).—No. 115904, U.S.N.M.; Charles Island, April 8, 1888; C. H. Townsend. Pileum and hind neck dull gray, the crown strongly tinged with olive-green; rest of upper parts grayish olive-green; wings and tail as in adult male, but yellow edgings paler, on terminal half or more of secondaries and ends of primaries passing into dull buffy whitish; under parts dull buffy white, tinged with olive-gray on sides and flanks and with pale yellow on anal region and under tail-coverts.

I am unable to appreciate any constant differences between specimens from the several islands. Immature birds exhibit every intermediate condition of plumage between the earliest stage, with dull white under parts and ashy gray hind neck and the full adult dress, as described above.

Although said to occur on the coast of Ecuador and Peru, I have not seen a specimen from any part of the mainland. Two adult males collected on Cocos Island by Mr. Townsend appear to be quite identical with Galapagos examples.

[1] "Legs flesh color, yellow behind; soles of feet yellow; bill dark brown above, bluish olive below." (Adams, MS.) Unfortunately it is not stated whether the specimen from which the notes were taken was an adult male or otherwise.

Measurements of Dendroica aureola.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
77759	U. S.	Adult male.	Abingdon Island		2.67	2.02	0.48	0.84	0.55
81785	U. S.	do	do	Apr. —, —	2.60	1.98	.48	.85	.49
			Average		2.64	2.00	.48	.85	.52
115993	U. S.	do	James Island	Apr. 11, 1888	2.68	1.95	.50	.88	.50
77760	U. S.	do	Indefatigable Island		2.70	2.05	.48	.88	.52
81789	U. S.	do	do	Oct. —, —	2.60	2.00	.47	.87	.50
			Average		2.65	2.03	.48	.88	.51
125904	U. S.	do	Duncan Island	Apr. 2, 1891	2.53	1.93	.48	.88	.51
115901	U. S.	do	Charles Island	Apr. 8, 1888		2.08	.48	.83	.49
125896	U. S.	do	do	Apr. 1, 1891	2.60	1.92	.48	.83	.50
			Average		2.60	2.00	.48	.83	.50
115935	U. S.	do	Chatham Island	Apr 4, 1888	2.68	2.00	.48	.83	
125898	U. S.	do	do	Mar. 25, 1891	2.53	1.92	.42	.81	.50
125900	U. S.	do	do	do	2.60	2.01	.46	.80	.50
			Average		2.60	1.98	.45	.81	.50
131678	U. S.	do	Cocos Island	Feb. 28, 1891	2.67	2.08	.45	.83	.50
131679	U. S.	do	do	do	2.53	1.95	.47	.82	.50
			Average		2.60	2.01	.46	.83	.50
115902	U. S.	Adult female	Charles Island	Apr. 8, 1888	2.59	1.97	.47		
125901	U. S.	do	Chatham Island	Mar. 30, 1891	2.45	1.85	.45	.80	.48
135650	U. S.	do	do	Apr. 4, 1891	2.48	1.88	.45	.81	
			Average		2.51	1.90	.46	.81	.48

Genus CERTHIDEA, Gould.

Certhidea, GOULD, Proc. Zool. Soc., Pt. v, 1837, p. 7. Type, *C. olivacea*, Gould.

Generic characters.—Bill rather small (exposed culmen less than two-thirds the tarsus, not longer than middle toe without claw, usually shorter), pointed, deeper than broad at base; culmen distinctly ridged, nearly or quite straight for basal half (more or less), the terminal portion very slightly curved and the extreme base sometimes slightly convex; gonys straight or very slightly convex, shorter than distance from nostril to tip of maxilla; maxillary tomium with an indistinct notch near tip (sometimes obvious only by very close inspection), its basal portion gradually curved downward from a point beneath or slightly anterior to nostril; nostrils exposed, rather large, horizontally oval, surrounded superiorly and posteriorly by membrane; rictal bristles distinct. Wing rather short (less than three times tarsus), rounded (second to fifth quills longest, first not longer than eighth), the primaries exceeding shortest secondaries by less than length of culmen. Tail short (more than two-thirds the wing, less than twice tarsus), rounded. Tarsi long and slender, about twice exposed culmen, with scutellæ indistinct on outer side; middle toe, with claw, decidedly shorter than tarsus; lateral claws reaching about to base of middle claw; hind toe about as long as lateral toes, but very much stouter,

its claw decidedly shorter than the digit. Colors, plain brownish, lighter below, with or without tawny-buff on throat or light wing-bars.

Notwithstanding the close general resemblance of the species of this genus to the females of certain Coerebidæ of the genus *Dacnis*, I have long been convinced that *Certhidea* belonged to the Mniotiltidæ rather than the Coerebidæ, where it had been placed by Messrs. Sclater and Salvin. This view of its relationships has been confirmed by an examination of its anatomical structure, made at my suggestion by Mr. F. A. Lucas. It is but fair to question, however, whether *Dacnis* itself, if examined in the same way, would be found to agree in certain structural characters with *Coereba*, *Arbelorhina*, and *Glossiptila*, the typical Coerebine forms with which Mr. Lucas' comparison of *Certhidea* was made.

Range.—Peculiar to the Galapagos Archipelago, where absent, apparently, only from Charles and Narborough Islands. (See map.)

Owing to their extremely plain coloration it is very difficult to construct a "key" to the species of this genus, a difficulty greatly enhanced by the circumstance that I have at the present time examples of only four of the eight forms before me, and among these but few specimens in good plumage, the extensive series belonging to Dr. Baur having some time since been returned. The following attempt, therefore, can only be regarded as provisional.

KEY TO THE SPECIES OF CERTHIDEA.

a^1. No whitish wing bars.

b^1. Adult males with superciliary stripe and throat ochraceous-buff or tawny; bill never (?) blackish.

c^1. Adult male with throat and superciliary stripe tawny or tawny ochraceous, remaining under parts dull light buffy. (James Island.)
1. *C. olivacea* (p. 498).

c^2. Adult male with throat and superciliary stripe ochraceous-buff, remaining under parts pale buff-yellow. (Indefatigable Island.)
2. *C. salvini* (p. 500).

b^2. Adult males without ochraceous-buff or tawny throat, etc.

c^1. Adults with chin like rest of under parts, or paler, and under wing-coverts whitish.

d^1. Bill never (?) black. (Albemarle Island) ..... 3. *C. albemarlei* (p. 500).

d^2. Bill black or blackish, at least in some breeding adults.

e^1. Bill larger (exposed culmen 0.40—0.45); upper parts distinctly olivaceous, lower parts strongly tinged with olive-yellowish.

f^1. Under parts distinctly buff yellowish, except in worn plumage. (Chatham Island)..... 4. *C. luteola* (p. 501).

f^2. Under parts buffy grayish white or very pale yellowish olive-gray. (Abingdon and Bindloe islands) ..... 5. *C. fusca* (p. 502).

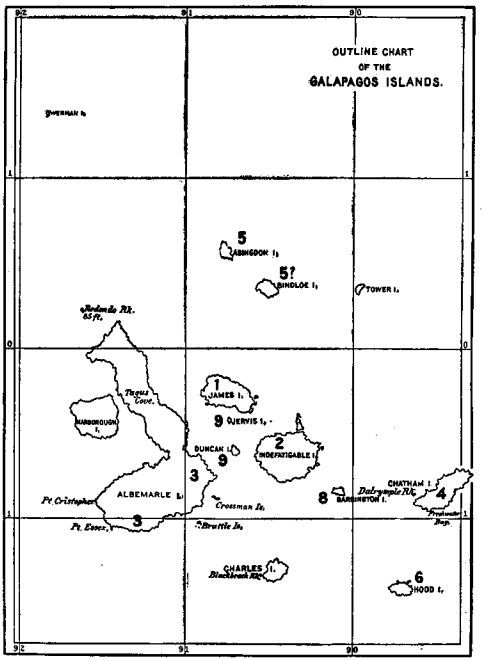
e^1. Bill smaller (exposed culmen less than 0.40); upper parts dull olive-gray, lower parts dull whitish. (Hood Island.)
6. *C. cinerascens* (p. 503).

c^2. Adult with chin and under wing-coverts buff. (Tower Island.)
7. *C. mentalis* (p. 504).

a^2. Two whitish wing bands. (Barrington Island)..... 8. *C. bifasciata* (p. 504).

Birds of this genus were collected by Messrs. Baur and Adams on Jervis and Duncan islands, but to what species they belong has not been determined, since the specimens were among those lost at Guayaquil.

ASCERTAINED RANGE OF THE GENUS CERTHIDEA, GOULD.



1. *Certhidea olivacea*, Gould.
2. *Certhidea salvini*, Ridgway.
3. *Certhidea albemarlei*, Ridgway.
4. *Certhidea luteola*, Ridgway.
5. *Certhidea fusca*, Sclater and Salvin.
6. *Certhidea cinerascens*, Ridgway.
7. *Certhidea mentalis*, Ridgway.
8. *Certhidea bifasciata*, Ridgway.
9. (Undetermined form.)

CERTHIDEA OLIVACEA, Gould.

Certhidea olivacea, GOULD, Proc. Zool. Soc., Pt. v, 1837, p. 7 (Galapagos Islands); Zool. Voy. Beagle, III, Birds, 1841, p. 106, pl. XLIV (part: James Island).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 476 (part: James Island specs. only).—SCLATER, Cat. Birds Brit. Mus., XI, 1886, p. 28 (part: James Island only).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, pp. 105, 119, 123, 125 (part: James Island).

Specific characters.—Plain light olive above, somewhat grayer on head and neck; under parts light buffy or cream-buff, shaded with light olive laterally; adult male with superciliary stripe, chin, and throat cinnamon-tawny or tawny ochraceous; mandible always (?) pale colored.

Range.—Galapagos Archipelago: James Island (Darwin, Townsend, Baur and Adams).

Adult male.—No. 556, collection Dr. G. Baur, James Island, August 17, 1891. Pileum and hind neck olive-gray; rest of upper parts light olive; wings and tail dusky, feathers edged with light olive, the middle wing-coverts broadly tipped and the greater coverts broadly edged with wood brown. A superciliary stripe, extending from bill to about 0.15 of an inch behind the eye, lower eyelid, malar region, chin, and throat cinnamon-tawny or deep tawny ochraceous; lores and suborbital region pale dull buffy; ear-coverts light buffy grayish; median portion of breast and abdomen and under tail-coverts cream-buff, many of the feathers of the breast marked with a more or less concealed, ill-defined spot of pale tawny, the shorter under tail-coverts tinged with the same color; lateral lower parts deep grayish buffy. Upper mandible dusky, lower entirely pale; "iris dark brown;" legs deep horn brown, the feet considerably darker. Length (skin), 3.60; wing, 2.15; tail, 1.40; exposed culmen, 0.32; tarsus, 0.80; middle toe, 0.48.

Young male.—No. 115995, U.S.N.M., James Island, April 11, 1894. Above similar to the adult, but plumage of looser texture, and wing-coverts margined terminally with cinnamon-buffy; beneath as in adult, except anteriorly, the chin, throat, and chest, as well as supraloral and superciliary regions, being dull buffy whitish or very pale dull grayish buffy.

It is singular that, although figured in the Zoology of the Beagle (Birds, pl. 44, lower figure[1]), the plumage of the adult male, as described above, has hitherto been undescribed, all authors, from Darwin and Gould to Salvin, ignoring it. It is so very distinct from the ordinary (immature) plumage as to give a decided impression at first of representing a different species. The specimen above described is the deepest colored of four adult males in the collection of Messrs. Baur and Adams, all the others being considerably paler, both as to the general color of the under parts and the tawny color of the throat, etc.

The two remaining specimens are also males, and were collected on the same dates as those in the tawny-throated plumage; but they are both evidently young birds, as are also the two *Albatross* specimens, collected April 11, one of the latter being a male, the other with sex undetermined.

All specimens seen of this species have the under mandible light colored.

[1] The figure is, however, very badly colored.

CERTHIDEA SALVINI, Ridgway.

Certhidea oliracea (nec GOULD), SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Indefatigable Island, Galapagos Archipelago).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 476 (excl. syn. part: Indefatigable Island).—SCLATER, Cat. Birds Brit. Mus., XI, 1886, p. 28 (Indefatigable Island).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, pp. 119, 122 (Indefatigable Island).

Certhidea salvini, RIDGWAY, Proc U. S. Nat. Mus., XVII, No. 1007, Nov. 15, 1894, p. 358 (Indefatigable Island; collection of Dr. G. Baur).

Specific characters.—Similar to *C. olivacea*, Gould, of James Island, but much yellower below, the upper parts more decidedly and uniformly olivaceous, and the bill larger; adult male with throat, etc., ochraceous-buff instead of tawny.

Range.—Galapagos Archipelago: Indefatigable Island (Habel, Baur and Adams).

Adult male.—Type, No. 438, collection of Dr. G. Baur, Indefatigable Island, August 6, 1891. Above brownish olive (decidedly browner than *C. olivacea*), the pileum and hind neck quite uniform with the back, etc., but the rump and upper tail-coverts brighter, more tinged with tawny olive; wings and tail dusky, the feathers edged broadly with the color of the back, inclining on greater wing-coverts to wood brown. Supraloral streak, orbits, chin, and throat, soft ochraceous-buff, the latter slightly mottled with buffy whitish; rest of under parts pale buff-yellow, deepening on sides and flanks into a more brownish tint. Upper mandible dark brown, lower brownish white; "iris dark brown;" legs dark horn brown; feet dusky. Length (skin), 3.60; wing, 2.10; tail, 1.38; exposed culmen, 0.40; tarsus, 0.81; middle toe, 0.48.

Adult female.—No. 77757, U.S.N.M., Indefatigable Island, August 30, 1868; Dr. A. Habel. Similar to the adult male, as described above, but supraloral streak, orbits, chin, and throat pale dull grayish buffy, like general color of under parts, only paler and duller. Wing, 2.10; tail, 1.40; tarsus, 0.79; middle toe, 0.50 (bill broken).

Females and immature males are much more olivaceous above than those of *C. olivacea*, and the under parts are conspicuously more yellowish.

All of the seven examples, two of which are in the United States National Museum collection, have the under mandible pale brown or whitish.

CERTHIDEA ALBEMARLEI, Ridgway.

Certhidea albemarlei, RIDGWAY, Proc. U. S. Nat. Mus., XVII, No. 1007, Nov. 15, 1894, p. 360 (Albemarle Island, Galapagos Archipelago; collection of Dr. G. Baur).

Specific characters.—Similar to *C. olivacea*, Gould, of James and Jervis islands, but under parts nearly clear pale buff, and tips of middle and greater wing-coverts deeper rusty.

Range.—Galapagos Archipelago: Albemarle Island (Baur and Adams).

Adult?.—Type, No. 595, collection Dr. G. Baur, Albemarle Island, July 21, 1891. Above uniform dull grayish brown, slightly tinged with olive; wings and tail dusky, the feathers broadly edged with the color of the back; middle and greater wing-coverts rather broadly tipped with cinnamon; under parts cream-buff, paler on belly, more brownish on sides and flanks. Upper mandible light brown, darker on culmen; lower mandible brownish white; tarsi pale horn color, toes somewhat darker. Wing, 2.05; tail, 1.45; exposed culmen, 0.40; tarsus, 0.83.

Another specimen from Cowley Bay, East Albemarle (August 10), is quite like the one described above.

CERTHIDEA LUTEOLA, Ridgway.

Certhidea olivacea (part), GOULD, Zool. Voy. Beagle, III, Birds, 1841, p. 106 (Chatham Island, Galapagos Archipelago).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 476 (part: Chatham Island).—SCLATER, Cat. Birds Brit. Mus., XI, 1886, p. 28 (Chatham Island).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, pp. 105 (part), 121 (Chatham Island).

Certhidea luteola, RIDGWAY, Proc. U. S. Nat. Mus., XVII. No. 1007, Nov. 15, 1894, p. 360 (Chatham Island, Galapagos Archipelago; collection of Dr. G. Baur).

Specific characters.—Most like *C. olivacea*, Gould, of James and Jervis islands, but much brighter olivaceous above and (except in very abraded plumage) distinctly buff-yellowish beneath.

Range.—Galapagos Archipelago: Chatham Island (Darwin, Townsend, Baur and Adams).

Adult male.—Type, No. 56, collection of Dr. G. Baur, Chatham Island, June 17, 1891. Above uniform bright olive or buffy olive; wings and tail dusky, feathers broadly edged with the color of the back, the tips of the middle and greater wing-coverts (rather broadly) pale olive-buff, producing two indistinct bands across the wing. Superciliary streak extending from nostrils to above posterior angle of eye, eyelids, and entire under parts light buff yellowish, deepest on throat, elsewhere tinged with olive, especially on sides and flanks; under wing-coverts and under tail-coverts pale yellowish buff. Bill wholly deep black; "iris brown;" legs and feet dark brown. Wing, 2.13; tail, 1.52; exposed culmen, 0.40; tarsus, 0.82; middle toe, 0.45.

Young male.—No. 115940, U.S.N.M., "high hills," Chatham Island, April 5, 1888, C. H. Townsend. Above deep olive brown, much darker on pileum (approaching sooty on forehead), more fulvescent on rump and upper tail-coverts, many of the feathers of top of head, hind neck, and back showing very indistinct tips of dusky, producing a very faintly mottled appearance: greater wing-coverts conspicuously edged and tipped with bright tawny; secondaries edged with tawny olive. Sides of head and neck, throat, and chest nearly uniform dull light grayish brown, mixed with pale dull buffy, the feathers dusky gray basally; sides and flanks similar but browner; median portion of under

parts, posterior to chest, dull pale buffy, nearly white on lower belly and anal region.

There are seven specimens of this very distinct form in Dr. Baur's collection, and six in the National Museum collection. None of the latter are in perfect plumage, however, and I have accordingly been obliged to select one of Dr. Baur's specimens as the type.

Two of Dr. Baur's specimens (both adult males, obtained June 17 and 18, while "in full song") and one of the United States National Museum specimens (obtained March 30, and in greatly worn plumage) have the bill entirely deep black. All the rest have the under mandible pale brownish, the upper deep brown or dusky. Among the latter are apparently adult birds of both sexes, obtained April 5 and June 16–18; but they may be young birds which have just assumed the adult plumage.

Measurements of Certhidea luteola.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
115939	U. S.	Adult	Chatham Island	Apr. 5, 1888	2.08	.....	.....	0.83	0.48
125908	U. S.	Adult male	do	Mar. 30, 1891	2.06	1.40	0.43	.81	.48
135654	U. S.	Adult	do	Apr. 4, 1888	2.05	1.48	.40	.81	.48
135655	U. S.	do	do	do	2.06	1.43	.41	.85	.48
			Average		2.06	1.44	.41	.82	.48

CERTHIDEA FUSCA, Sclater and Salvin.

Certhidea fusca, SCLATER and SALVIN, Proc. Zool. Soc., 1870, pp. 323, 324 (Abingdon and Bindloe islands, Galapagos Archipelago); Nom. Av. Neotr., 1873, p. 16.—SALVIN, Trans. Zool. Soc., IX. Pt. IX, 1876, p. 477.—SCLATER, Cat. Birds Brit. Mus., XI, 1886, p. 28.—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, pp. 105, 119, 123, 124, 126 (Abingdon Island).

Specific characters.—Similar to *C. olivacea*, Gould, but darker and less olivaceous, the under parts buffy grayish white or very pale yellowish olive-gray; bill more dusky (wholly black in adult male); adult male without tawny or ochraceous-buff on throat or superciliary region.

Range.—Galapagos Archipelago: Abingdon Island (Habel, Townsend; Bindloe Island, Habel).

Adult male.—No 116100, U.S.N.M., Abingdon Island, April 16, 1888, C. H. Townsend. Above uniform grayish olive, the wing edgings similar but rather paler on tips of greater and middle coverts; supraloral streak, orbits, and lower parts generally dull pale grayish buffy (the buff clearer and more pronounced on throat), deepening on sides and flanks into buffy olive-grayish and fading on belly and under-tail coverts into buffy whitish. Bill brownish black, rather paler on basal portion of mandible; tarsi dark horn color, toes darker. Length (skin), 3.95; wing, 2; tail, 1.40; exposed culmen, 0.40; tarsus, 0.80; middle toe, 0.45.

Adult female?.—No. 116102, U.S.N.M.; same locality and collector, April 16, 1888. Similar to the specimen described above, but slightly paler beneath and on sides of head, with throat less tinged with buffy; basal half of mandible and maxillary tomium horn brown. Length (skin), 4.05; wing, 2.02; tail, 1.42; exposed culmen, 0.42; tarsus, 0.80; middle toe, 0.47.

Another adult male, No. 116101, U.S.N.M., obtained April 16, has the under mandible distinctly light colored, except at tip, thus showing the color of the bill to be an inconstant feature in this as well as in some other species of the genus.

Young.—No. 116103, U.S.N.M., Abingdon Island, April 16, 1888, C. H. Townsend. Above similar to adult, but rather browner, and feathers, especially on back, hind neck, and pileum, showing in certain lights very indistinct narrow terminal bars of dusky; beneath much as in adult, but sides of head and neck, throat, and chest more grayish; sides and flanks faintly mottled with light grayish brown, the flanks tinged with pale buffy.

Measurements of Certhidea fusca.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
116100	U. S.	Adult male	Abingdon Island	Apr. 16, 1888	2.00	1.42	0.45	0.82	0.48
116101	U. S.	do	do	do	.....	.....	.42	.80	.45
116102	U. S.	Adult female?	do	do	2.06	1.42	.45	.80	.45
116105	U. S.	Adult male	do	do	2.05	1.30	.42	.80	.45
135683	U. S.	Adult	do	do	.....	1.45	.....	.....	.....
			Average		2.04	1.40	.44	.80	.46

CERTHIDEA CINERASCENS, Ridgway.

Certhidea cinerascens, RIDGWAY, Proc. U. S. Nat. Mus., XII, No. 767, Feb. 5, 1890, pp. 105, 119, 127 (Hood Island, Galapagos Archipelago; collection of U. S. Nat. Mus.).

Certhidea olivascens (lapsus penna), RIDGWAY, Proc. U. S. Nat. Mus., XII, 1890, p. 124 (Hood Island).

Specific characters.—Similar to *C. fusca*, Sclater and Salvin, of Abingdon Island, but much grayer above and whiter beneath, and bill smaller.

Range.—Galapagos Archipelago: Hood Island (Townsend, Baur and Adams).

Adult male.—Type, No. 116069, Hood Island, Galapagos, April 7, 1888, U. S. S. *Albatross*. Above plain dull brownish gray, beneath wholly dull grayish white, faintly tinged with buffy, especially along sides. Bill black, basal half of lower mandible horn-color; legs and feet deep black. Length (skin), 3.85; wing, 2; tail, 1.40; exposed culmen, 0.37; bill from rictus, 0.45; tarsus, 0.73; middle toe, 0.43.

CERTHIDEA MENTALIS, Ridgway.

Certhidea mentalis, RIDGWAY, Proc. U. S. Nat. Mus., XVII, No. 1007, Nov. 15, 1894, p. 359 (Tower Island, Galapagos Archipelago; collection of Dr. G. Baur).

Specific characters.—Similar to *C. fusca*, Sclater and Salvin, of Abingdon Island, but rather smaller, color darker and less olivaceous, the under parts dull light olive-grayish, becoming pale buffy on chin and under wing-coverts.

Range.—Galapagos Archipelago: Tower Island (Baur and Adams).

Adult.—Type, No. 594, collection of Dr. G. Baur, Tower Island, September 2, 1891. Above uniform deep grayish olive; chin, throat, and under wing-coverts pale buff, deepest on chin, that of throat changing gradually on chest to buffy gray, which covers whole chest, upper breast, sides, and flanks; belly dull whitish; under tail coverts buffy white. An indistinct whitish supraloral streak. Wing, 2.05, tail, 1.58; exposed culmen, 0.40; tarsus, 0.80.

There are five specimens in Dr. Baur's collection, one of which has the under mandible apparently black, one dark brown, the other three brownish white.

CERTHIDEA BIFASCIATA, Ridgway.

Certhidea bifasciata, RIDGWAY, Proc. U. S. Nat. Mus. XVII, No. 1007, Nov. 15, 1894, p. 359 Barrington Island, Galapagos Archipelago; collection of Dr. G. Baur).

Specific characters.—Most like *C. cinerascens*, Ridgway, of Hood Island, but still whiter (entirely almost pure white) beneath, and wing with two broad whitish bands across tips of greater and middle coverts.

Range.—Galapagos Archipelago: Barrington Island (Baur and Adams).

Adult.—Type, No. 593, collection of Dr. G. Baur, Barrington Island, July 9, 1891. Above brownish gray, becoming very much paler on the rump; wings and tail dusky, the feathers broadly edged with grayish brown; middle wing-coverts broadly tipped with pale dull buffy, and greater coverts with dull white, producing two conspicuous bands across the wing. Lores, orbits, cheeks, and entire under parts uniform dull white. Upper mandible dark brown, edged with whitish; under mandible whitish; legs and feet brownish black. Length (skin), 3.40; wing, 2; tail, 1.40; exposed culmen, 0.40; tarsus, 0.78; middle toe, 0.48.

Three specimens from Barrington Island agree in the above characters.

Family HIRUNDINIDÆ.

Genus PROGNE, Boie.

Progne, BOIE, Isis, 1826, p. 971. Type, *Hirundo purpurea*, Linnæus, = *H. subis*, Linnæus.

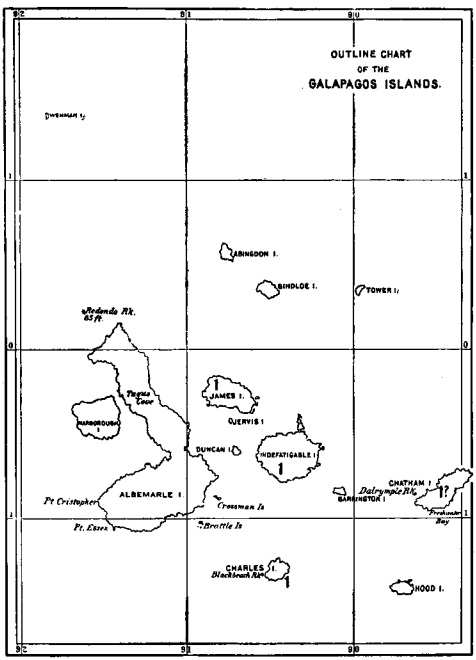
Range.—The whole of temperate and tropical America. Galapagos Archipelago (one peculiar species).

PROGNE MODESTA (Néboux).

Hirundo concolor (nec SYKES, 1832), GOULD, Proc. Zool. Soc., Pt. v, 1837, p. 22 (Galapagos Archipelago; collection of Zool. Soc. Lond).

Progne concolor, BONAPARTE, Consp. Av., I, 1850, p. 337.—BAIRD, Rev. Amer. Birds, I, 1864, p. 278.—SALVIN, Trans. Zool. Soc., IX. Pt. IX, 1876, p. 476 —SHARPE, Cat. Birds Brit. Mus., X, 1885, p. 176 ("Chatham Island"[1]).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 105 (Eden Rock, Indefatigable Island).

ASCERTAINED RANGE OF THE GENUS PROGNE, BOIE, IN GALAPAGOS ARCHIPELAGO.



1. *Progne modesta* (Néboux).

Hirundo modesta, NÉBOUX, Rev. Zool., 1840, p. 291 (Charles Island).—SUNDEVALL, Proc. Zool. Soc., 1871, p. 125 (James Island).

Progne modesta,[2] GOULD, Zool. Voy. Beagle, III, Birds, 1841, p. 39, pl. v (James Island, Galapagos).—PRÉVOST et DES MURS, Voy. Vénus, 1855, p. 182.

[1] Although Dr. Sharpe gives Chatham Island as the locality of Darwin's specimen, Mr. Darwin himself says he obtained it on James Island.

[2] *Progne modestus* on plate.

Specific characters.—Similar to *P. subis* (Linnæus), but much smaller; adult male less glossy, and "having no silky white feathers on the sides of the back or sides of the breast" (Sharpe); adult female much darker than that of *P. subis*.

Range.—Galapagos Archipelago: Charles Island (Néboux); Indefatigable Island (Habel,[1] *Albatross*); James Island (Darwin, Kinberg).

Adult male.—"Similar to *P. purpurea* [i. e., *P. subis*], but smaller, and having no silky white feathers either on the sides of the back or sides of the breast. Total length, 6.5 inches; culmen, 0.45; wing, 4.95; tail, 2.7; tarsus, 0.45." (Sharpe.[2])

Adult female.—No. 116038, U.S.N.M., Eden Rock, Indefatigable Island, April 12; U. S. S. *Albatross*. Above sooty blackish, strongly glossed with violaceous steel blue on back, scapulars, and rump, more faintly glossed with greenish on wings and tail. Under parts deep sooty brown, the feathers with very indistinct and narrow paler terminal margins. Wing, 4.85; tail, 2.40 (middle feathers, 1.90); exposed culmen, 0.42; width of bill at rictus, 0.58, at anterior frontal feathers, 0.35; tarsus, 0.49; middle toe, 0.50.

According to Gould[3] the adult male has "the upper and under surface not so strongly a marked purple shade as in *P. purpurea*. The primaries and feathers of the tail, however, have a greenish gloss, perhaps slightly more metallic. Tail not so deeply forked as in *P. purpurea*, which is owing to the two external feathers on each side not being so much prolonged and bent outward as in that species. Nostrils of less size than in the latter, although the beaks differ but little. Claws and feet are much less strong," etc.

The single adult male in the National Museum collection (No. 52412, U.S.N.M., James Island, obtained from Professor Sundevall) is in worn and tarnished plumage and therefore unfit for description. Its measurements are as follows: Length (skin), 6.10; wing, 4.85; tail, 2.42 (middle feathers, 1.85); exposed culmen, 0.45, width of bill at base, 0.55; tarsus, 0.48; middle toe, 0.45.

The female of this species is totally different in the coloration of the lower parts from that of *P. subis*, but much resembles "*P. elegans*," Baird,[4] which was based on an immature male and young female of *P. furcata*, Baird.[5] It differs, however, from the two examples of "*P. elegans*" in having the paler tips to the feathers of the under parts far less distinct (only appreciable, in fact, at near view).

In the volume of the British Museum catalogue cited above, Mr. Sharpe gives Chatham Island as the locality of the type specimen.

[1] Seen, but not collected, at Puerto de la Aguada; see Trans. Zool. Soc. Lond., IX, Pt. IX, 1876, p. 459.

[2] Cat. Birds Brit. Mus., X, 1885, p. 176.

[3] Zool. Beag., III, p. 39.

[4] Review Amer. Birds, p. 275.

[5] See Sharpe, Cat. Birds Brit. Mus., X, p. 176.

This can not be, however, since Mr. Darwin[1] mentions only James Island as its habitat. Mr. Sharpe has made similar mistakes regarding type localities of *Geospiza nebulosa* and *G. parvula*.

Family FRINGILLIDÆ.

Genus GEOSPIZA, Gould.

Geospiza, GOULD, Proc. Zool. Soc., Pt. v, 1837, p. 5. Type, *G. magnirostris*, Gould.
Cactornis, GOULD, Proc. Zool. Soc., Pt. v, 1837, p. 6. Type, *C. scandens*, Gould.

Generic characters.—Bill exceedingly variable in relative length, depth, and width, its lateral outlines and gonys nearly (sometimes quite) straight, and tip acute; culmen, from extreme base, less than two-thirds to quite as long as tarsus; depth of bill at base less than half culmen to nearly as long as culmen, but always greater than width of mandible at base; culmen more or less convex (always most so basally), but sometimes almost straight; the basal portion usually strongly ridged and sometimes elevated and strongly arched; gonys straight or almost inappreciably convex, decidedly shorter than length of maxilla from nostril; maxillary tomium without subterminal notch, first faintly (sometimes almost inappreciably) concave, then about as much convex, again reëntering at the beginning of the abrupt and very conspicuous basal deflection; mandibular tomium nearly straight or slightly convex, with its basal portion abruptly deflected, but the angle thus formed not toothed; nostrils very small, oval or nearly circular; no obvious rictal bristles. Wing rather short (a little more than 3 to nearly 3½ times tarsus), rounded (second to fourth quills longest, first not longer than fifth, usually shorter); primaries exceeding secondaries by less than exposed culmen; tertials not longer than secondaries. Tail short (decidedly more than half the wing, a little less to a little more than twice as long as tarsus), slightly rounded, the feathers broad, with rounded tips, about half hidden by the coverts. Outstretched feet reaching to or beyond tip of tail; tarsus about equal to middle toe with claw (sometimes a little longer or shorter), its scutellæ distinct; lateral toes very long, reaching to nearly middle of last phalanx of middle toe, their claws reaching to or decidedly beyond the base of the middle claw; hind toe shorter than lateral toes, its claw nearly or quite as long as the digit. Color: Fully adult males entirely black, including bill and feet, but under tail-coverts with broad whitish or buffy margins; immature males, females, and young grayish brown streaked and spotted with dusky above, beneath light colored with conspicuous dusky streaks, the bill largely light colored (except in some adult females and immature males).

Range.—Peculiar to the Galapagos Archipelago.

Few genera equal the present one in the extreme modifications in the form of the bill, which in some species (*magnirostris* and *strenua*) is

[1] Zoology of the Beagle, Birds, p. 39.

perhaps not excelled by that of any other member of the family Fringillidæ in its extreme thickness, in others (members of the so called genus *Cactornis*) slender and decurved, in others very acute, with straight outlines, and in others still elevated and arched at the base. The most extreme forms are, however, so gradually connected by intermediate types, that there seems no possibility of satisfactorily subdividing the genus into two or more sections. The extreme modifications of the bill and some of the connecting forms are shown in the outline illustrations on Plate LVII.

The reduction of *Cactornis* to a synonym of *Geospiza* has already been made in my paper describing the new species of Galapagos birds in Dr. Baur's collection,[1] in which is announced "the discovery of species which absolutely bridge the previously existing gap between the so-called genera *Geospiza* and *Cactornis*, thus necessitating the suppression of one of these names (the latter, according to the rule of priority)."

Dr. Baur, who has had the advantage of studying these birds in life, disapproves of this, as the following extract from one of his letters will show:

> I should like to make a few remarks, if you will permit me, about *Cactornis* and *Geospiza*. You place the species of these two genera in one genus, *Geospiza*. I do not think that this is natural. Both have their peculiar representatives on the different islands, and if you place them together this peculiar differentiation of each is lost sight of. *Cactornis* is more slender than *Geospiza*, and has many more black individuals. I would keep the two genera apart, and would not hesitate to place *G. propinqua* in *Cactornis*.

I am quite willing to adopt Dr. Baur's views concerning the position of *G. propinqua*, which I had compared with *G. conirostris* (a true *Geospiza*); but, while admitting that it would be very convenient to recognize *Cactornis* if any definite characters could be found, I am still of the opinion that not a single character can be found which will serve to separate them. The character which comes nearest to doing so is, apparently, the relative width of the mandible between the bases of the rami to the length of the gonys, which is very much less in typical "*Cactornis*" than in true *Geospiza*. This greater compression of the bill even serves to trenchantly separate "*Cactornis*" *propinqua* from *G. conirostris*, some individuals of which are almost precisely alike in the lateral profile and measurements of the bill; but the use of this character as a generic one would necessitate the removal of *Geospiza difficilis* and *G. acutirostris*, perhaps also *G. parvula*, to *Cactornis;* and it is difficult to see how the group can be divided into two genera without one or two more being necessary; for there is certainly more difference between such species as *Geospiza magnirostris* and *G. pachyrhyncha* on the one hand and *G. fuliginosa*, *G. debilirostris*, etc., on the other, than

[1] Descriptions of Twenty-two New Species of Birds from the Galapagos Islands. Proc. U. S. Nat. Mus., XVII (advance sheets published November 15, 1894), pp. 357–370.

between "*Cactornis*" *brevirostris* and *Geospiza fraterculа*, or between *C. propinqua* and *G. conirostris*. Furthermore, if this group be recognized to consist of two or more genera instead of one, then, to be consistent, *Camarhynchus* must also be divided into three genera.

A very careful consideration of all the facts in the case, as they appear to me, compels me to conclude that the safest course is to regard the species of "*Cactornis*" as simply more slender-billed *Geospiza*, the degree of departure from the typical Geospizine bill being largely a specific character. This is a conclusion which I regret having to adopt, for I regard large genera as a nuisance, and would be glad to have the slightest excuse for keeping *Geospiza* to its old limits.

As a matter of convenience, I have separated the species into two groups, which correspond in their limits with *Cactornis* and *Geospiza* as usually recognized;[1] but how slight and unsatisfactory a basis this division rests upon may be seen by reference to the characters given in the first part of the following "key to the species."

Owing to the gradual transition from one form to another, and the almost perfect resemblance between them in coloration, I have found it impossible to construct an analytical "key" to the species after the usual plan, but have drawn up the following as an aid to their more ready identification. I am prevented from making the "key" more satisfactory by the circumstance that I have no specimens of *G. assimilis* and *G. barringtoni* for comparison with the other so-called *Cactorni*, and am therefore unable to give comparative measurements of these forms alongside of *G. fatigata* and *G. abingdoni*.

KEY TO THE SPECIES OF GEOSPIZA.

a[1]. Width of mandible at base (across chin) nearly or quite equal to, sometimes greater than, length of gonys..... Subgenus *Geospiza*.

a[2]. Width of mandible at base (across chin) much less than length of gonys. Subgenus *Cactornis*.

Subgenus GEOSPIZA.

a[1]. Depth of bill at base greater than length of maxilla from nostril.

b[1]. Bill very short and thick, its depth at base very much greater than length of maxilla from nostril.

c[1]. Gonys more than 0.50 of an inch.

d[1]. Wing 3.55–3.70, tail 2–2.10. (Charles and Chatham Islands.)
1. *G. magnirostris* (p. 512).

d[2]. Wing less than 3.50, tail less than 2.

e[1]. Depth of bill at base more than 0.80; width of mandible at base (across chin) more than 0.65. (Tower Island.)
2. *G. pachyrhyncha* (p. 516).

e[2]. Depth of bill at base less than 0.80; width of mandible at base (across chin) less than 0.65. (Abingdon, Bindloe, James, Jervis, Indefatigable, Chatham, and Charles islands.)
3. *G. strenua* (p. 514).

[1] With this difference: *Cactornis pallida*, Sclater and Salvin, I have transferred to *Camarhynchus*, to which it is certainly far more nearly related (see p. 544).

c^2. Gonys less than 0.50 of an inch. (Chatham Island; Albemarle Island?.)
4. *G. dubia* (p. 519).

b^2. Bill moderately short and thick, its depth at base little if any greater than length of maxilla from nostril.

c^1. Length of maxilla from nostril more than 0.50.

d^1. Culmen nearly straight, much exceeding 0.80 (0.85–0.95). (Hood Island.)
5. *G. conirostris* (p. 516).

d^2. Culmen decidedly convex, not exceeding 0.80 (0.78–0.80).

e^1. Larger: Wing 3.20, depth of bill at base 0.68. (James Island.)
6. *G. bauri* (p. 518).

e^2 Smaller: Wing 2.90–3.10, depth of bill at base 0.60–0.65. (Hood Island.) ..... 7. *G. media* (p. 517).

c^2. Length of maxilla from nostril less than 0.50.

d^1. Wing 2.50 or more.

e^1. Depth of bill at base not less than 0.50 (0.50–0.53). (Charles, Chatham, James, Indefatigable, Albemarle, and Bindloe islands.)
8. *G. fortis* (p. 521).

e^2. Depth of bill at base less than 0.50.

f^1. Depth of bill at base 0.40 or more. (Abingdon Island.)
9. *G. fratercula* (p. 525).

f^2. Depth of bill at base less than 0.40. (Chatham, James, Indefatigable, Duncan, Charles, Hood, Albemarle, and Abingdon islands.)
10. *G. fuliginosa* (p. 526).

d^2. Wing less than 2.50.

e^1. Bill shorter (from nostril 0.30), culmen more curved. (James, Bindloe, Abingdon, and Chatham islands.)
11. *G. parvula* (p. 529).

e^2. Bill longer (from nostril 0.40), more acute, culmen nearly straight. (Tower Island.) ..... 12. *G. acutirostris* (p. 531).

a^2. Depth of bill at base less than length of maxilla from nostril.

b^1. Maxillary tomium slightly toothed. (Charles Island; Chatham Island.)
13. *G. dentirostris* (p. 532).

b^2. Maxilliary tomium not toothed.

c^1. Culmen nearly straight, much elevated basally; wing 2.35–2.45. (Abingdon Island; Charles Island??) .... 14. *G. difficilis* (p. 532).

c^2. Culmen more convex, less elevated basally; wing 2.90. (James Island.) ..... 15. *G. debilirostris* (p. 533).

Subgenus CACTORNIS.

a^1. Depth of bill at nostril not exceeding length of gonys.

b^1. Culmen not more than 0.72. (James Island).. 16 (1). *G. scandens* (p. 534).

b^2. Culmen 0.75 or more.

c^1. Culmen not more than 0.79, basal depth of bill not more than 0.40. (Charles Island) ..... 17 (2). *G. intermedia* (p. 535).

c^2. Culmen not less than 0.79, basal depth of bill not less than 0.40.

(Bindloe Island) ..... 18 (3). *G. assimilis* (p. 537).

(Indefatigable Island) ..... 19 (4). *G. fatigata* (p. 539).

(Abingdon Island) ..... 20 (5). *G. abingdoni* (p. 540).

(Barrington Island) ..... 21 (6). *G barringtoni* (p. 541).

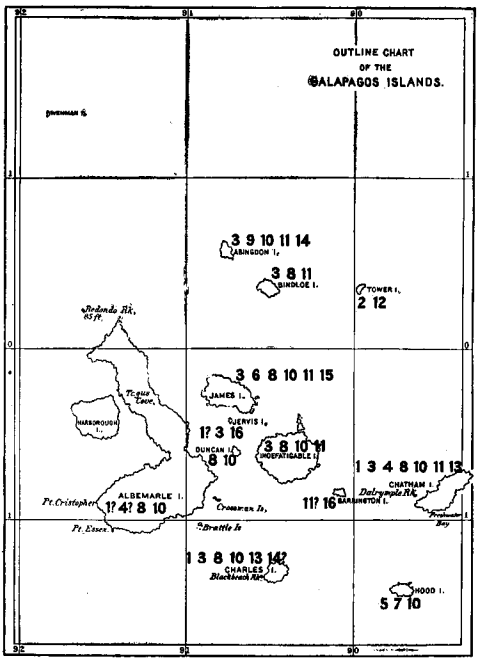
a^2. Depth of bill at nostril exceeding length of gonys.

b^1. Smaller, with more slender and pointed bill; culmen 0.70–0.72, wing 2.70–2.80. (Charles Island; Indefatigable Island?.)
22 (7). *G. brevirostris* (p. 541).

b^2. Large, with stouter and blunter bills; culmen 0.82–0.90, wing 2.95–3.15. (Tower Island) ..... 23 (8). *G. propinqua* (p. 543).

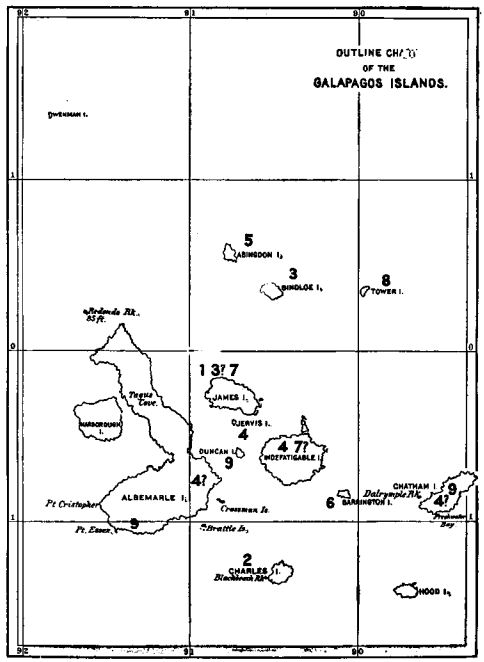
ASCERTAINED RANGE OF THE GENUS GEOSPIZA, GOULD.

a. Subgenus GEOSPIZA.



1. *Geospiza magnirostris*, Gould.
2. *Geospiza pachyrhyncha*, Ridgway.
3. *Geospiza strenua*, Gould.
4. *Geospiza dubia*, Gould.
5. *Geospiza conirostris*, Ridgway.
6. *Geospiza bauri*, Ridgway.
7. *Geospiza media*, Ridgway.
8. *Geospiza fortis*, Gould.
9. *Geospiza fratercula*, Ridgway.
10. *Geospiza fuliginosa*, Gould.
11. *Geospiza parvula*, Gould.
12. *Geospiza acutirostris*, Ridgway.
13. *Geospiza dentirostris*, Gould.
14. *Geospiza difficilis*, Sharpe.
15. *Geospiza debilirostris*, Ridgway.
16. (Undetermined form.)

b. Subgenus **CACTORNIS**, Gould.



1. *Geospiza scandens* (Gould).
2. *Geospiza intermedia*, Ridgway.
3. *Geospiza assimilis* (Gould).
4. *Geospiza fatigata*, Ridgway.
5. *Geospiza abingdoni* (Sclater and Salvin).
6. *Geospiza barringtoni*, Ridgway.
7. *Geospiza brevirostris*, Ridgway.
8. *Geospiza propinqua*, Ridgway.
9. (Undetermined form.)

GEOSPIZA MAGNIROSTRIS, Gould.

(Plate LVII, fig. 10.)

Geospiza magnirostris, GOULD, Proc. Zool. Soc., Pt. v, 1837, p. 5 (Galapagos Islands[1]); Zool. Voy. Beagle, III, Birds, 1841, p. 100, pl. XXXVI (Charles and Chatham islands).—BONAPARTE, Consp. Av., I, 1850, p. 542.—GRAY, Hand-l., II, 1870, p. 88.—SCLATER and SALVIN, Nom. Av. Neotr., 1873, p. 27.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 478 (fig. of bill).—SHARPE, Cat. Birds Brit. Mus., XII, 1888, p. 7 (Chatham and Charles islands).—†BAUR, Amer. Nat., XXV, 1891, p. 905 (South Albemarle and Jervis islands).

[1] According to Sharpe, the types are from Chatham Island; but in view of his erroneous statement of the type locality in the case of other species, as *G. parvula*, *G. nebulosa*, and *Progne modesta*), there is room for doubt as to this.

Specific characters.—Largest species of the genus, with largest and thickest bill. Wing, 3.55–3.70 in males; 3.25–3.45 in females; culmen, 1.

Range.—Galapagos Archipelago: ?South Albemarle Island (Baur and Adams);[1] Charles Island (Darwin); Chatham Island (Darwin); ?Jervis Island (Baur and Adams[1]).

"*Adult male.*—Entirely black above and below; quills and tail feathers blackish brown; under tail-coverts black, broadly edged and tipped with white. Total length, 5.2 inches; culmen, 1; wing, 3.55; tail, 2.1; tarsus, 1.

"In what I take to be the *seasonal plumage* a browner shade pervades the black, the feathers having edges of obscure brown; these pale edges are lighter and more conspicuous on the abdomen; under tail-coverts white with black bases.

"*Adult female.*—Different from the male; general color above brown, the feathers edged with ashy olive, especially on the rump and upper tail-coverts; wings like the back, edged with pale ashy, the greater coverts whiter on the margins; bastard wing, primary coverts, and quills dark brown edged with pale ashy, clearer whity brown on the margins of the primaries; tail-feathers pale brown, with ashy brown margins; crown of head rather darker than the back, blackish, with slightly indicated pale edges to the feathers; lores, sides of face, and ear-coverts ashy olive-brown, darker brown along the upper edge of the latter; cheeks a little darker brown; throat dark brown, streaked with ashy margins to the feathers; remainder of under surface whity brown with a slight olive tinge, the fore neck and chest streaked with dark brown centers to the feathers; the sides of the body and flanks brown, also streaked with darker brown; thighs and under tail-coverts, under wing-coverts, and axillaries whity brown, slightly tinged with olive; quills below dusky brown, ashy white along the inner edge. Total length, 6 inches; culmen, 1; wing, 3.35; tail, 2; tarsus, 1.

"None of the seven specimens in the Museum have the sexes or dates of capture marked, but the brown birds, which I take to be all females, have shorter wings than the black males. In the latter the length of the wing is from 3.55 to 3.7 inches, and in the females 3.25 to 3.45. The bill in the females varies in color, probably with season, becoming much blacker, and the increase in the color of the bill is accompanied by a blacker tone of plumage, the upper surface having the ashy margins less pronounced, while the under surface of the body is thickly mottled with black spots." (Sharpe.)

It is very singular that this powerfully built form has not been seen by any collector since Darwin's visit to the Galapagos. It seems to be near *G. strenua*, but still larger; so closely related, in fact, that Mr. Salvin has "little doubt that a large series of the skins would show that the dimensions . graduate into those of *G. strenua*."[2]

[1] See Dr. G. Baur, Amer. Nat., XXV, 1891, p. 905. The specimens having been lost, the identification is doubtful.

[2] Trans. Zool. Soc. Lond., IX. Pt. IX, 1876, p. 479.

GEOSPIZA STRENUA, Gould.

Geospiza strenua, GOULD, Proc. Zool. Soc., Pt. v, 1837, p. 5 (Galapagos Islands[1]); Zool. Voy. Beagle, III, 1841, p. 100, pl. 37 (James and Chatham islands).—BONAPARTE, Consp. Av., I, 1850, p. 542.—GRAY, Hand-l., I, 1870, p. 88.—SCLATER and SALVIN, Proc. Zool. Soc. 1870, p. 323 (Indefatigable, Bindloe, and Abingdon islands); Nom. Av. Neotr., 1873, p. 27.—SUNDEVALL, Proc. Zool. Soc., 1871, p. 124 (James Island).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 479 (James, Chatham, Bindloe, and Abingdon islands).—SHARPE, Cat. Birds Brit. Mus., XII, 1888, p. 88 (Chatham, James, Indefatigable, Abingdon, and Bindloe islands).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 105 (Abingdon and Charles islands).

Specific characters.—Similar to *G. magnirostris*, Gould, but smaller; wing, about 3–3.25; tail, 1.85–1.95; culmen, 0.83–0.93; depth of bill at base, 0.72–0.78; tarsus, 0.92–1.

Range.—Galapagos Archipelago: Charles Island (*Albatross*); Chatham Island (Darwin); Indefatigable Island (Habel); James Island (Darwin, Kinberg); Bindloe Island (Habel); Abingdon Island (Habel).

Male, nearly adult.—No. 77746, U.S.N.M.; Abingdon Island, Galapagos; Dr. A. Habel. Head, neck, and chest uniform brownish black; rest of upper parts duller blackish, the feathers with grayish-brown or olive-grayish margins, less distinct on back, but very conspicuous on rump, where giving the prevailing color; under parts, posterior to chest, dull blackish broken by light olive-grayish margins to the feathers, these becoming broader and more tinged with buffy posteriorly, the under tail-coverts dull grayish buffy white with a central spot of dusky. Maxilla chiefly black for basal half, terminal portion more horn colored; mandible chiefly light horn color, unsymmetrically clouded with dusky; legs and feet blackish horn color. Length (skin), 5.50; wing, 3.23; tail, 1.95; culmen, 0.93; depth of bill at base, 0.78; width of mandible at base, 0.60; tarsus, 0.95; middle toe, 0.70.

Immature male.—No. 116196, U.S.N.M.; Abingdon Island, April 16, 1888; C. H. Townsend. Similar to the above-described specimen, but uniform black confined to head (occiput excepted), the occiput, hind neck, back, scapulars, etc., grayish olive with black centers to the feathers; outermost greater wing-coverts edged with brownish buff; under parts buffy grayish white, the chest and breast spotted with blackish, other portions streaked (more broadly on sides and flanks) with the same; bill black, the mandible tinged with brown; feet horn black. Length (skin), 5.80; wing, 3.12; tail, 1.88; culmen, 0.87; depth of bill at base, 0.72; width of mandible at base, 0.59; tarsus 1; middle toe, 0.70.

Adult female.—No. 116107, U.S.N.M.; Abingdon Island, April 16, 1888; C. H. Townsend. Pileum blackish dusky, the feathers edged with olive-gray; rest of upper parts rather light olive-brown and dusky, the latter

[1] The type in the British Museum collection is said by Sharpe to be from Chatham Island.

in the form of central spots to the feathers, most conspicuous on back and scapulars; wings as in the immature male described above, but light-colored margins to the feathers broader as well as paler. Sides of head pale grayish buffy indistinctly clouded with darker; chin and throat grayish dusky, indistinctly streaked with pale grayish buff; rest of under parts very pale grayish buff, the chest, upper breast, sides, and flanks broadly streaked with dusky, the under tail-coverts with broad brownish gray central spots. Maxilla and upper basal portion of mandible deep brown, darker next to head; mandible (except as described) horn-yellowish; legs and feet dusky. Length (skin), 5.65; wing, 3; tail, 1.90; culmen, 0.83; depth of bill at base, 0.72; width of mandible at base, 0.53; tarsus, 0.92; middle toe, 0.67.

The specimens examined include four from Abingdon Island, three from Bindloe, one from Charles, one from Indefatigable, four from James, and four from Jervis. None have been seen by me from Chatham Island, the alleged type locality. The specimens from James, Jervis, and Indefatigable islands, belonging to Dr. Baur's collection, have been returned without the opportunity occurring of comparing them closely with those from other islands.

I am not satisfied as to the propriety of considering the specimens from Bindloe Island referred by Mr. Salvin to this species as really the same form, but believe that they represent a local race, all of the three examples in the United States National Museum collection having the bill decidedly broader and relatively shorter, as well as lighter colored.

Measurements of Geospiza strenua.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Basal depth of bill.	Gonys.	Basal width of mandible.	Tarsus.	Middle toe.
77746	U. S.	Adult male...	Abingdon Island.	.....	3.23	1.98	0.92	....	0.49	0.61	0.95	0.72
77747	U. S.	Immature male.	.....do	.....	3.02	1.96	.91	0.78	.49	.55	.95	.71
116106	U. S.	.....do	.....do	Apr. 16, 1888	3.14	1.92	.88	.75	.48	.57	.99	.70
			Average....	.....	3.16	1.95	.90	.77	.49	.58	.96	.71
77748	U. S.	.....do	Bindloe Island...	Feb. —, ——	3.15	1.95	.93	.80	.50	.61	1.00	.78
83781	U. S.	.....do	.....do	Nov. —, ——	3.30	2.02	.90	.80	.49	.61	1.00	.78
83782	U. S.	.....do	.....do	....do	3.00	1.91	.90	.76	.49	.58	.91	.70
			Average....	.....	3.15	1.96	.91	.78	.49	.60	.97	.75
115905	U. S.	.....do	Charles Island...	Apr. 8. 1888	3.08	1.72	.87	.78	.50	.53	.96	.70
116107	U. S.	Immature female.	Abingdon Island.	Apr. 16. 1888	3.02	1.90	.88	.76	.48	.53	.90	.65

GEOSPIZA PACHYRHYNCHA, Ridgway.

(Plate LVII, fig. 9.)

Geospiza pachyrhyncha, RIDGWAY, Proc. U. S. Nat. Mus., XVIII, No. 1067, April 23, 1896, p. 293 (Tower Island, Galapagos Archipelago; collection of Dr. G. Baur).

Specific characters.—Similar to *G. strenua*, Gould, but bill much thicker and broader at the base than in that form, in this respect nearly or quite equaling *G. magnirostris*.

Range.—Galapagos Archipelago: Tower Island (Baur and Adams).

Specimens of this form having been returned to Dr. Baur, to whose collection they belong, I am not able to give a detailed description. Fortunately, however, I made a careful drawing of the bill of one of them, which shows the following measurements: Culmen, plus 0.90; depth of bill at base, 0.88; width of mandible at base, 0.70; gonys, 0.40. The bill is thus nearly if not quite as thick at the base as that of *G. magnirostris*, but it is much shorter, thus greatly increasing its relative thickness.

GEOSPIZA CONIROSTRIS, Ridgway.

(Plate LVII, fig. 8.)

Geospiza conirostris, RIDGWAY, Proc. U. S. Nat. Mus., XII, No. 767, Feb. 5, 1890, p. 106, fig. 2 (Hood Island, Galapagos Archipelago; coll. U. S. Nat. Mus.)

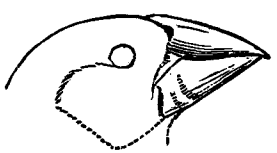


Fig. 3. *Head of Geospiza conirostris.*

Specific characters.—Similar to *G. strenua*, Gould, but bill much more elongated, much narrower, and culmen less arched.

Range.—Galapagos Archipelago: Hood Island (*Albatross;* Baur and Adams).

Adult male.—Type, No. 116070, U.S.N.M.; Hood Island, Galapagos, April 7, 1888; C. H. Townsend. Uniform black, the longer under tail-coverts margined (rather broadly) with white; bill, legs, and feet wholly black. Length (skin), 5.70; wing, 3.25; tail, 1.95; culmen, 0.95; gonys, 0.52; width of lower mandible at base, 0.51; depth of bill at base, 0.70; tarsus, 0.95; middle toe, 0.72.

Adult female.—No. 116076, U.S.N.M., same locality, etc. Much duller black than the male, or dull slate-dusky, broken on the belly, flanks, etc., by dull whitish streaks (edgings to feathers); all the under tail-coverts margined with dull whitish; under mandible dull brownish in middle portion; legs and feet dull black. Length (skin), 5.50; wing, 3.10 (quills worn at tip); tail, 1.68 (feathers very much worn at tip); culmen, 0.90; gonys, 0.50; width of under mandible at base, 0.48; depth of bill at base, 0.62; tarsus, 0.95; middle toe, 0.68.

Immature (?) male.—No. 116075, U.S.N.M, same locality, etc. Similar to the adult female as described above, but rather more sooty, and lower mandible pale brownish, with base and tip dusky. Length

(skin), 5.75; wing, 3; tail, 1.82; culmen, 0.91; gonys, 0.50; width of under mandible at base, 0.48; depth of bill at base, 0.68; tarsus, 0.95; middle toe, 0.73.

Immature (?) *female.*—No. 116077, U.S.N.M.; same locality, etc. Above dull sooty; anterior lower parts similar, but indistinctly streaked with pale grayish buffy, this gradually increasing posteriorly until it becomes the prevailing color and the sooty reduced to broad streaks. Length (skin), 5.70; wing, 3; tail, 1.80; culmen, 0.89; gonys, 0.50; width of lower mandible at base, 0.47; depth of bill at base, 0.62; tarsus, 0.92; middle toe, 0.67. Bill intermediate in color between that of adult female and immature male described above.

Three additional adults (two of them males, the third with sex not determined) agree minutely in form and size of bill and other measurements with the adult specimens described, one of the males being like the type in coloration while the other corresponds in plumage with the adult female described.

Measurements of Geospiza conirostris.

Number.	Collection.	Sex and age.	Locality	Date.	Wing.	Tail.	Culmen.	Depth of bill at base.	Tarsus.	Middle toe.
116070	U.S.N.M.	Adult male	Hood Island, Galapagos.	Apr. 7, 1888	3.25	1.95	0.95	0.70	0.95	0.72
116071	U.S.N.M.	do	do	do	3.25	1.90	.92	.70	.93	.70
116073	U.S.N.M.	Young male	do	do	(3.08)	1.90	.85	.....	.92	.75
116075	U.S.N.M.	do	do	do	(3.00)	(1.82)	.91	.68	.95	.73
116076	U.S.N.M.	Adult female	do	do	3.10	(1.68)	.90	.62	.95	.68
116077	U.S.N.M.	Young female?	do	do	3.00	1.80	.89	.62	.92	.67
149831	U.S.N.M.	.....	do	do	2.95	1.75	.89	.67	.90	.....
149827	U.S.N.M.	.....	do	do	2.98	1.82	.93	.72	.90	.68
			Average		2.95	1.85	.90	.67	.93	.70

GEOSPIZA MEDIA, Ridgway.

(Plate LVII, fig. 13.)

Geospiza media, RIDGWAY, Proc. U. S. Nat. Mus., XII, No. 767, Feb. 5, 1890, p. 107, fig. 3 (Hood Island, Galapagos Archipelago; collection U. S. Nat. Mus.).

Specific characters.—Similar to *G. conirostris*, but slightly smaller, with bill much smaller and less elongated.

Range.—Galapagos Archipelago: Hood Island (*Albatross*).

Adult male.—Type, No. 116072, U.S.N.M.; Hood Island, Galapagos, April 7, 1888; C. H. Townsend. Uniform dull black, the under tail-coverts broadly margined with buffy white; bill, legs, and feet wholly black. Length (skin), 5.50; wing, 3.10; tail, 1.90; culmen, 0.80; gonys, 0.42; width of mandible at base, 0.45; depth of bill at base, 0.62; tarsus, 0.90; middle toe, 0.65.

Immature male?.—No. 149829, U.S.N.M.; same locality, etc. Uniform sooty blackish brown, with edges of primaries (narrowly) and of

abdominal feathers and under tail-coverts buffy whitish; bill light brown, with basal half of maxilla dusky. Length (skin), 5; wing, 2.90; tail, 1.75; culmen, 0.78; gonys, 0.45; width of mandible at base, 0.45; depth of bill at base, 0.62; tarsus, 0.90; middle toe, 0.70.

Adult female?.—No. 149828, U.S.N.M.; same locality, etc. Similar to the supposed immature male, as described above, but under parts much more broadly and extensively streaked with whitish, only the chin and throat being uniform dusky. Length (skin), 4.90; wing, 2.95; tail, 1.75; culmen, 0.78; gonys, 0.42; width of mandible at base, 0.43; depth of bill at base, 0.60; tarsus, 0.92; middle toe, 0.70.

From the subjoined measurements, it will be seen, if they are compared with those of *G. conirostris*, on page 517, that *G. media* and *G. conirostris* inosculate with respect to all measurements except length of culmen, which is constantly less in the present form; but it should be stated that all the specimens of *G. conirostris* which closely approach *G. media* in measurements are either females or immature birds. It is possible that the two supposed forms really represent extremes of one variable local race; but should this prove to be the case, the difference between the extremes (as, for example, the types of the two, both adult males in perfect black plumage) is certainly remarkable.

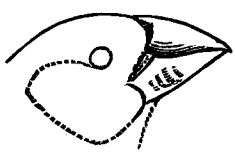


Fig. 4. *Head of Geospiza media.*

Measurements of Geospiza media.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Depth of bill at base.	Tarsus.	Middle toe.
116072	U.S.N.M.	Adult male....	Hood Island, Galapagos.	Apr. 7, 1888	3.05	1.90	0.80	0.62	0.90	0.65
149829	U.S.N.M.	Young male?..	.....do.....	.....do.....	2.90	1.75	.78	.62	.90	.70
149830	U.S.N.M.	.....do.....	.....do.....	.....do.....	2.92	1.75	.80	.65	.91	.72
149828	U.S.N.M.	Adult female?.	.....do.....	.....do.....	2.95	1.75	.78	.60	.92	.70
			Average.....		2.95	1.79	.78	.62	.91	.72

GEOSPIZA BAURI, Ridgway.

(Plate LVII, fig. 12.)

Geospiza bauri, RIDGWAY, Proc. U. S. Nat. Mus., XVII, No. 1007, Nov. 15, 1894, p. 362 (James Island, Galapagos Archipelago; collection of Dr. G. Baur).

Specific characters.—Similar to *G. media*, Ridgway, of Hood Island, but slightly larger, with bill much higher at base. Wing, 3.20; tail, 2; culmen, 0.80; depth of bill at base, 0.68; tarsus, 0.93.

Range.—Galapagos Archipelago: James Island (Baur and Adams). (Type, No. 562, adult male, collection Dr. G. Baur, James Island, August 7, 1891.)

One adult male, an immature male, and an immature female are in Dr. Baur's collection.

This form approaches *G. strenua* in the size and form of the beak, but the gap between them is very considerable. The bill is also proportionally much more compressed than in *G. strenua*.

GEOSPIZA DUBIA, Gould.

(Plate LVII, fig. 11.)

Geospiza dubia, GOULD, Proc. Zool. Soc., Pt. v, 1837, p. 6 (Galapagos Islands); Zool. Voy. Beagle, III, Birds, 1841, p. 103 (Chatham Island).—BONAPARTE, Consp. Av., I, 1850, p. 543.—GRAY, Hand-l., II, 1870, p. 88.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 480 (Chatham Island).—SHARPE, Cat. Birds Brit. Mus., XII, 1888, p. 9 (Chatham Island).

Geospiza fortis (part), GOULD, Zool. Voy. Beagle, III, Birds, 1841, p. 101 (Chatham Island).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 107 (Chatham Island).

Geospiza nebulosa (nec GOULD), SUNDEVALL, Proc. Zool. Soc., 1871, p. 125 (part) (Chatham Island).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 482 (Chatham Island).—SHARPE, Cat. Birds Brit. Mus., XII, 1888, p. 11 (part).

Specific characters.—Similar to *G. fortis*, Gould, but larger, with relatively larger and more turgid bill. Wing, 2.78–2.90; tail, 1.70–1.83; culmen, 0.65–0.75; depth of bill at base, 0.52–0.59; tarsus, 0.84–0.90.

Range.—Galapagos Archipelago: Chatham Island (Darwin, Kinberg, Townsend, Baur and Adams).

Adult male.—No. 125914, U.S.N.M.; Chatham Island, Galapagos, March 30, 1891; C. H. Townsend. Uniform deep black, the feathers abruptly clear slate-gray beneath the surface; under tail-coverts slate-gray basally, very pale brownish buff terminally and laterally (broadly), with a central, more or less cordate, spot of black. Bill wholly deep black; legs and feet grayish black. Length (skin), 5.30; wing, 2.95; tail, 1.75; culmen, 0.70; gonys, 0.38; basal width of mandible, 0.48; basal depth of bill, 0.58; tarsus, 0.85; middle toe, 0.60.

Immature male.—No. 115943, U.S.N.M.; Chatham Island, April 5, 1888; C. H. Townsend. Head and neck dull black, broken by sooty grayish brown edgings and mottlings; upper parts chiefly grayish brown, the feathers with paler edges, many of those on the back (new molt) dull black with indistinct brownish gray margins; feathers of chest and breast black with pale grayish buffy margins, producing an irregular spotted or clouded appearance; rest of under parts pale grayish buffy broadly striped with dusky, the longer under tail-coverts, however, nearly immaculate. Bill entirely black; legs and feet horn dusky. Length (skin), 4.90; wing, 2.70; tail, 1.65; culmen, 0.73; gonys, 0.38; basal width of mandible, 0.38; basal depth of bill, 0.52; tarsus, 0.86; middle toe, 0.60.

Younger (?) male.—No. 125917, U.S.N.M.; same locality, etc. Similar above to the preceding, but under parts without any "solid" black, the throat and fore neck being pale grayish buffy irregularly streaked and

clouded with dusky, and feathers of chest and breast with smaller, more longitudinal, spots of more brownish dusky. Bill wholly black and legs and feet dusky, as in the preceding. Length (skin), 4.40; wing, 2.70; tail, 1.57; culmen, 0.71; gonys, 0.38; basal width of mandible, 0.45; basal depth of bill, 0.58; tarsus, 0.90; middle toe, 0.63.

Adult female.—No. 125916, U.S.N.M.; same locality, etc. Similar to the supposed immature male last described, but pileum dusky sooty brownish with grayish brown edgings, instead of nearly uniform dusky; under parts with dusky longitudinal spots and streaks slightly less distinct; bill with terminal third of maxilla and greater part of mandible brownish; legs and feet brownish dusky. Length (skin), 4.50; wing, 2.70; tail, 1.60; culmen, 0.72; gonys, 0.40; basal width of mandible, 0.44; basal depth of bill, 0.59; tarsus, 0.90; middle toe, 0.63.

Young male?[1]—No. 115945, U.S.N.M.; same locality, etc. Essentially like the supposed immature male (No. 115943) described above, but upper parts more tinged with olive-brown, greater wing-coverts edged with light buffy brown, and dusky color of anterior under parts much less intense, being dull grayish dusky instead of sooty black; mandible pale brownish yellow with a large squarish or trapezoidal dusky spot on each ramus.

Young female?.—No. 125920, U.S.N.M.; same locality and collector, March 30, 1891. Much lighter colored, both above and below, than the supposed young male (No. 115945), the general color of the upper parts being rather light brownish olive, the feathers of the pileum and back with dusky central spots; anterior under parts with the dull grayish dusky streaks about equal in width to the dull buffy grayish white interspaces; terminal portion of maxilla yellowish, and dusky spot on mandibular rami smaller.

A series of thirteen adult males from Chatham Island, compared with five from Charles Island, shows that the birds from the two localities can not properly be considered the same. Altogether there are in the National Museum and Dr. Baur's collections thirty-one specimens, nearly half of which are adult males in the black plumage, of the present form, and of these only three specimens (all males in the striped plumage, but with black bills) which approach very closely in size and shape of the bill to the stoutest billed examples from Charles Island.

I think there can be no question that Gould's *Geospiza dubia* was based on a young example of this form. In the large series of specimens now before me (thirty-one altogether) are several which answer in every particular to the original description except in a single measurement, that of the depth of the bill, which is given as three-eighths of an inch. None of the specimens before me have the bill less than one-half an inch in depth at the base, the average being about five-eighths,

[1] This specimen is marked "♀," but I doubt the correctness of the determination of sex.

and it is altogether probable that the "$\frac{3}{8}$" given in the original description is a misprint for "$\frac{5}{8}$".

The type of *G. dubia* having become lost, I have on the whole considered it best to identify this form as that species rather than give it a new name. In so doing I have selected an adult male as the substitute type in order to make easier the comparison of the different forms of this difficult genus.

Measurements of Geospiza dubia.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Basal depth of bill.	Gonys.	Basal width of mandible.	Tarsus.	Middle toe.
115942	U. S.	Adult male...	Chatham Island..	Apr. 5, 1888	2.90	1.78	.73	.57	.39	.42	.85	.65
115943	U. S.	Immature male	....do	....do	2.70	1.65	.70	.52	.39	.39	.85	.59
115944	U. S.	....do	....do	....do	2.70	1.63	.69	.52	.37	.40	.85	.60
125909	U. S.	Adult male....	....do	Mar. 30, 1891	3.00	1.80	.76	.60	.40	.45	.91	.67
125910	U. S.	.....do	....do	....do	2.78	1.70	.65	.55	.38	.40	.85	.61
125911	U. S.	.....do	....do	....do	3.00	1.80	.75	.61	.40	.49	.91	.70
125912	U. S.	.....do	....do	....do	2.90	1.75	.73	.58	.40	.45	.90	.64
125914	U. S.	.....do	....do	....do	2.88	1.75	.70	.57	.40	.45	.87	.60
125915	U. S.	.....do	....do	....do	2.90	1.73	.67	.53	.33	.40	.88	.60
125917	U. S.	.....do	....do	....do	....	....	.70	.57	.38	.46	.90	.62
			Average....	.....	2.74	1.73	.71	.56	.38	.43	.89	.63
125916	U. S.	Adult female.	Chatham Island..	Mar. 30, 1891	....	....	.73	.59	.39	.42	.88	.63
125918	U. S.	Adult female?	.....do	....do	2.80	1.72	.70	.53	.37	.41	.85	.60
			Average....	.....	2.80	1.72	.72	.56	.38	.42	.87	.62

GEOSPIZA FORTIS, Gould.

(Plate LVII, figs. 14, 15.)

Geospiza fortis, GOULD, Proc. Zool. Soc., Pt. v, 1837, p. 5 (Galapagos Islands); Zool. Voy. Beagle, III, Birds, 1841, p. 101, pl. XXXVIII (part: Charles Island).—BONAPARTE, Consp. Av., I, 1850, p. 543.—GRAY, Hand-l., II, 1870, p. 88.—SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (part: Indefatigable and Bindloe islands); Nom. Av. Neotr., 1873, p. 27.—SUNDEVALL, Proc. Zool. Soc., 1871, p. 124 (Charles and James islands).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 481 (part: Charles, James, Indefatigable, and Bindloe islands).—SHARPE, Cat. Birds Brit. Mus., XII, 1888, p. 10 (part: James, Charles, and Bindloe islands).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 107 (part: Charles, James, and Indefatigable islands).

† *Geospiza nebulosa*, GOULD, Proc. Zool. Soc., Pt. v, 1837, p. 5 (Galapagos Islands); Zool. Voy. Beagle, III, Birds, 1841, p. 101 (Charles Island).—BONAPARTE, Consp. Av., I, 1850, p. 543.—GRAY, Hand-l., II, 1870, p. 88.—SUNDEVALL, Proc. Zool. Soc., 1871, p. 125 (part: Charles Island).—SCLATER and SALVIN, Nom. Av., Neotr., 1873, p. 27.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 482 (part: Charles Island).—SHARPE, Cat. Birds Brit. Mus., XII, 1888, p. 11 (part: Charles Island).

† *Geospiza albemarlei*, RIDGWAY, Proc. U. S. Nat. Mus., XVII, No. 1006, June 27, 1894, p. 362 (Albemarle Island, Galapagos Archipelago; collection U. S. Nat. Mus.).

Specific characters.—Similar to *G. dubia*, Gould, of Chatham Island, but smaller, the bill especially. Wing, about 2.75–2.85; tail, 1.65–1.80; culmen, 0.62–0.68; depth of bill at base, 0.42–0.49; tarsus, 0.80–0.85.

Range.—Galapagos Archipelago: Albemarle Island (Townsend); Duncan Island (Baur and Adams); Charles Island (Darwin, Kinberg, Townsend, Baur and Adams); Indefatigable Island (Habel, *Albatross*); James Island (Kinberg, *Albatross*); Bindloe Island (Habel).

Adult male.—No. 125937, U.S.N.M.; Charles Island, Galapagos, April 1, 1891; C. H. Townsend. Uniform deep black, most intense anteriorly, tinged with dark olive-gray posteriorly, the feathers abruptly clear slate-gray beneath the surface; under tail-coverts broadly margined with buffy whitish; bill wholly deep black; legs and feet blackish brown. Length (skin), 4.80; wing, 2.82; tail, 1.75; culmen, 0.62; gonys, 0.35; basal width of mandible, 0.37; basal depth of bill, 0.48; tarsus, 0.80; middle toe, 0.62.

Immature male.—No. 125939, U.S.N.M.; same locality, etc. Above dull grayish black, the feathers indistinctly margined with olive-gray, this color prevailing on rump and upper tail-coverts; beneath dull grayish white, faintly tinged with pale buffy, broadly striped with black, these black stripes or longitudinal spots broader anteriorly, much exceeding the whitish interspaces on chin, throat, and chest; bill wholly deep black; legs and feet blackish brown. Length (skin), 4.70; wing, 2.80; tail, 1.65; culmen, 0.65; gonys, 0.35; basal width of mandible, 0.37; basal depth of bill, 0.49; tarsus, 0.82; middle toe, 0.61.

Adult female.—No. 125946, U.S.N.M.; same locality, etc. Similar above to the immature male, as described above, but feathers more distinctly margined with grayish olive, the rump nearly uniformly of this color; ground-color of under parts more tinged with buffy than in immature male, and with blackish markings less coalesced on anterior portions; maxilla blackish brown, mandible pale brown, becoming blackish brown basally; legs and feet dark horn brown. Length (skin), 4.65; wing, 2.82; tail, 1.65; culmen, 0.65; gonys, 0.33; basal width of mandible, 0.37; basal depth of bill, 0.48; tarsus, 0.85; middle toe, 0.58.

Immature female.—No. 77752, U.S.N.M.; Indefatigable Island, Galapagos, August 10, 1868; Dr. A. Habel. Pileum as in adult female; rest of upper parts rather light grayish olive, the feathers of the back, etc., dusky centrally, producing a clouded appearance; rump uniform light olive or buffy olive; middle and greater wing-coverts broadly margined with light dull cinnamon or wood brown; under parts dull buffy whitish, washed with light buffy brown on sides and flanks; chin and throat clouded with grayish dusky; fore neck and chest marked with triangular longitudinal spots of the same, the breast and anterior portion of sides similarly but less distinctly marked. Bill pale cinnamon-brown passing into pale buff on under portion of mandible and into deeper brown on basal part of maxilla; legs and feet blackish brown. Length (skin), 4.50; wing, 2.85; tail, 1.80; culmen, 0.68; gonys,

0.35; basal width of mandible, 0.35; basal depth of bill, 0.42; tarsus, 0.81; middle toe, 0.58.

Fifty-six specimens of this form have been examined, of which thirty belong to the National Museum collection. The localities represented are as follows: Charles Island (15 specimens), James Island (22), Indefatigable Island (12), Albemarle Island (4), Bindloe Island (2), and Duncan Island (1).

Specimens from Albemarle Island appear to be clearly referable to this species, and agree most closely in form and size of the bill with those from James, Charles, Indefatigable, Abingdon, and Bindloe islands; but in the same locality occur others which I am unable to distinguish satisfactorily from smaller examples of the larger, heavier-billed Chatham Island bird (*G. dubia*). These I at one time separated as *G. albemarlei*, comparison having been made, through some inadvertence, with *G. dubia* and *G. media* instead of the former and *G. fortis*. The name *G. albemarlei* is therefore placed as a probable synonym of *G. fortis*, with the reservation that a larger series of specimens may show that its separation can be maintained.[1]

[1] The original description of *G. albemarlei* is as follows:

Geospiza albemarlei, Ridgway.

Specific characters.—Intermediate between *G. media*, of Hood Island, and *G. dubia*, Gould, of Chatham.

Habitat.—Albemarle Island, Galapagos.

Measurements of type.—No. 115977, U.S.N.M., immature male, Tagus Cove, Albemarle Island, April 10, C. H. Townsend. Length (skin), 5; wing, 2.80; tail, 1.85; culmen, 0.70; gonys, 0.35; width of lower mandible at base, 0.41; depth of bill at base, 0.52; tarsus, 0.85; middle toe, 0.60.

The plumage of the type specimen is about halfway between that of the young male and the perfectly adult bird, the head and neck being nearly uniform dull blackish, the feathers of the dorsal region black, broadly margined with olive, the under parts (except throat) dull buffy whitish (marked with buffy olive laterally); the entire breast and fore part of sides heavily spotted (longitudinally) with blackish.

An adult female (No. 115978, U.S.N.M., same locality, etc.) is exactly like the immature male in coloration, its measurement being as follows: Length (skin), 5; wing, 2.82; tail, 1.70; culmen, 0.75; gonys, 0.40; width of under mandible at base, 0.42; depth of bill at base, 0.55; tarsus, 0.90; middle toe, 0.65.

Another female (No. 115975, U.S.N.M., same locality, etc.), evidently not a very young bird, since its bill, like that of the two above-mentioned specimens, is hard and chiefly black in color, has the top of the head grayish olive, broadly streaked with dusky, the cheek, chin, throat, etc., very pale grayish buffy, obsoletely streaked with darker, and the breast rather indistinctly marked with dusky. Length (skin), 4.70; wing, 2.78; tail, 1.70; culmen, 0.70; gonys, 0.38; width of under mandible at base, 0.40; depth of bill at base, 0.52; tarsus, 0.90; middle toe, 0.62.

Measurements of Geospiza fortis.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Basal depth of bill.	Gonys.	Basal width of mandible.	Tarsus.	Middle toe.
115998	U. S.	Adult male	James Island	Apr. 11, 1888	2.80	1.73	.67	.52	.34	.41	.88	.65
115999	U. S.	do	do	do	2.95	1.75	.65	.52	.35	.40	.87	.60
116000	U. S.	do	do	do	2.85	1.65	.70	.52	.37	.40	.85	.62
116001	U. S.	do	do	do	2.80	1.62	.69	.53	.36	.41	.86	.59
116002	U. S.	do	do	do	2.76	1.65	.66	.48	.34	.40	.87	.63
			Average		2.77	1.65	.67	.52	.35	.40	.87	.62
77752	U. S.	Immature male	Indefatigable Island.	Apr. —, ——	2.83	1.82	.70	.45	.36	.37	.83	.60
83783	U. S.	do	do	do	2.60	1.75	.71	.50	.38	.40	.85	.62
116042	U. S.	do	do	Apr. 12, 1888	2.80	1.70	.73	.53	.40	.43	.88	.62
116043	U. S.	do	do	do	2.70	1.65	.65	.50	.34	.38	.81	.58
			Average		2.73	1.73	.70	.50	.37	.40	.84	.61
115976	U. S.	Adult male	Albemarle Island	Apr. 10, 1888	2.82	1.72	.65	.48	.35	.39	.90	.61
115977	U. S.	Immature male	do	do	2.87	1.78	.70	.55	.37	.41	.87	.63
			Average		2.85	1.75	.68	.52	.36	.40	.88	.62
115906	U. S.	Immature male	Charles Island	Apr. 8, 1888	2.76	1.71	.68	.49	.38	.38	.87	.65
125933	U. S.	Adult male	do	Apr. 1, 1891	2.77	1.63	.67	.52	.35	.40	.82	.60
125934	U. S.	do	do	do	2.83	1.72	.70	.50	.35	.40	.87	.62
125935	U. S.	do	do	do	2.91	1.82	.70	.52	.38	.40	.85	.61
125936	U. S.	Immature male	do	do	2.85	1.70	.63	.49	.38	.39	.83	.60
125937	U. S.	Adult male	do	do	2.85	1.78	.66	.50	.37	.39	.83	.65
125938	U. S.	do	do	do	2.91	1.75	.68	.53	....	.40	.88	.62
125939	U. S.	do	do	do	2.83	1.65	.69	.51	.35	.40	.85	.63
125942	U. S.	Immature male	do	do	2.63	1.60	.64	.50	.35	.38	.83	.62
			Average		2.81	1.70	.67	.51	.36	.39	.85	.62
77750	U. S.	do	Bindloe Island	.....	2.62	1.65	.67	.51	.38	.39	.78	.57
77751	U. S.	do	do	.....	2.63	1.55	.67	.52	.38	.39	.80	.59
			Average		2.63	1.60	.67	.52	.38	.39	.79	.58
115907	U. S.	Immature female.	Charles Island	Apr. 8, 1888	....	1.70	.67	.49	.35	.38	.87	.61
125940	U. S.	Adult female	do	Apr. 1, 1891	2.70	1.65	.65	.47	.35	.33	.80	.55
125941	U. S.	do	do	do	2.65	1.69	.65	.50	.33	.38	.79	.56
125944	U. S.	do	do	do	2.68	1.60	.63	.49	.35	.38	.80	.60
125945	U. S.	do	do	do	2.63	1.64	.61	....	.32	.33	.82	.59
125946	U. S.	do	do	do	2.83	1.65	.69	.50	.33	.38	.85	.60
			Average		2.70	1.64	.65	.49	.34	.36	.82	.59
115975	U. S.	do	Albemarle Island	Apr. 10, 1888	2.80	1.72	.71	.52	.39	.41	.90	.66
115978	U. S.	do	do	do	2.82	1.70	.77	.57	.40	.42	.90	.65
129808	U. S.	do	do	do	2.90	1.72	.75	.53	.38	.40	.89	.63
			Average		2.84	1.71	.74	.54	.39	.41	.90	.65
125961	U. S.	Immature female.	Duncan Island	Apr. 2, 1891	2.59	1.50	.62	.45	.32	.35	.81	.53

GEOSPIZA FRATERCULA, Ridgway.

(Plate LVII, fig. 16.)

Geospiza fortis (nec GOULD), SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 481 (part: Abingdon Island).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 107 (Abingdon Island).

Geospiza fraterecula, RIDGWAY, Proc. U. S. Nat. Mus., XVII, No. 1007, Nov. 15, 1894, p. 363 (Abingdon Island, Galapagos Archipelago; collection U. S. Nat. Mus.).

Specific characters.—Similar to *G. fortis*, Gould, of Charles Island, but smaller, the bill narrower and with culmen more convex. Adult males: Wing, 2.50–2.65; tail, 1.60–1.65; culmen, 0.65–0.67; basal width of mandible 0.36–0.40; depth of bill at base, 0.43–0.49; tarsus, 0.78–0.80.

Range.—Galapagos Archipelago: Abingdon Island (Habel, *Albatross*).

Adult male.—Type, No. 116110, U.S.N.M.; Abingdon Island, Galapagos, April 16, 1888; C. H. Townsend. Entirely deep black, very faintly tinged with olive posteriorly, especially on the rump, all the feathers abruptly clear slate-gray beneath the surface; bill wholly deep black; legs and feet brownish black. Length (skin), 4.65; wing, 2.68; tail, 1.72; culmen, 0.63; gonys, 0.34; basal width of mandible, 0.35; basal depth of bill, 0.42; tarsus, 0.80; middle toe, 0.53.

Immature (?) male.—No. 116109, U.S.N.M.; same locality, etc. Head, neck, and chest uniform black; rest of upper parts black, the feathers margined with olive, most broadly so on back, scapulars, rump, and upper tail-coverts; breast and sides duller black, the feathers margined with light olive-grayish; flanks grayish brown; middle of belly and anal region dull whitish, the feathers dusky beneath the surface; under tail-coverts light buff, each feather with a dusky wedge-shaped central space; bill and feet as in the fully adult male. Length (skin), 4.75; wing, 2.58; tail, 1.70; culmen, 0.65; gonys, 0.34; basal width of mandible, 0.36; basal depth of bill, 0.45; tarsus, 0.77; middle toe, 0.54.

Young male.—No. 116113, U.S.N.M.; same locality, etc. Above brownish black, the feathers margined with olive, especially on back, scapulars, rump, etc.; middle and greater wing-coverts broadly margined with dark buffy or clay color; chin and throat grayish dusky obsoletely streaked with pale buffy grayish; chest and upper breast with broad streaks of dusky and narrower ones of pale grayish buffy; rest of under parts plain grayish buffy white medially, olive grayish laterally, tinged with brownish buffy and obsoletely streaked with darker; under tail-coverts very pale buff or buffy white; bill dark brown, with the terminal and lower halves of the mandible pale yellowish; legs and feet brownish dusky.

Some other young males in first plumage differ from the one described in being darker (nearly uniform blackish brown) above, and in having the whole chin and throat "solid" dusky.

Five adult males in the United States National Museum collection from Abingdon Island agree in the above characters, by which they

may readily be distinguished from *G. fortis*, of Charles and other islands. There are four young birds in the collection, but no adult females. Mr. Salvin says that "the females from Abingdon Island are darker than those from the other two islands" (Indefatigable and Bindloe).

Measurements of Geospiza fratercula.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Basal depth of bill.	Gonys.	Basal width of mandible.	Tarsus.	Middle toe.
116108	U. S.	Adult male	Abingdon Island	Apr. 16, 1888	2.53	1.52	.65	.44	.38	.38	.81	.55
116109	U. S.	.....do	.....do	.....do	2.55	1.68	.68	.48	.36	.38	.78	.55
116110	U. S.	Immature male	.....do	.....do	2.65	1.70	.65	.44	.38	.36	.80	.55
116111	U. S.	.....do	.....do	.....do	2.60	1.62	.68	.48	.37	.38	.79	.58
116112	U. S.	.....do	.....do	.....do	2.53	1.59	.67	.50	.37	.40	.80	.57
			Average		2.57	1.62	.67	.47	.37	.38	.80	.56

GEOSPIZA FULIGINOSA, Gould.

(Plate LVII, fig. 17.)

Geospiza fuliginosa, GOULD, Proc. Zool., Soc., Pt. v, 1837, p. 5 (Galapagos Islands[1]); Zool. Voy. Beagle, III, Birds, 1841, p. 101 (Chatham and James islands).—BONAPARTE, Consp. Av., I, 1850, p. 543.—GRAY, Hand-l., II, 1870, p. 88.—SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Indefatigable Island); Nom. Av. Neotr., 1873, p. 27.—SUNDEVALL, Proc. Zool. Soc., 1871, p. 125 (Indefatigable and James islands).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 482 (Chatham, James, and Indefatigable islands).—SHARPE, Proc. Zool. Soc., 1877, p. 66 (Albemarle Island); Cat. Birds Brit. Mus., XII, 1888, p. 12 (Chatham, James, Albemarle, and Indefatigable islands).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 107 (Chatham, James, Indefatigable, Duncan, Charles, Hood, Albemarle, and Abingdon islands).

[*Geospiza fuligineux*, PRÉVOST et DES MURS, Voy. Vénus, Ois., 1855, p. 208.]

Specific characters.—Similar to *G. fratercula*, Ridgway, of Abingdon Island, but smaller, the bill more compressed and with straighter outlines. Wing, about 2.40–2.55; tail, 1.45–1.65; culmen, 0.49–0.55; depth of bill at base, 0.31–0.38; tarsus, 0.73–0.81. (Adult males.)

Range.—Galapagos Archipelago: Albemarle Island (Cookson, *Albatross*, Baur and Adams); Duncan Island (*Albatross*, Baur and Adams); Charles Island (Kinberg, Townsend); Hood Island (*Albatross*, Baur and Adams); Chatham Island (Darwin, Kinberg, Townsend, Baur and Adams); Indefatigable Island (Habel, *Albatross*); James Island (Darwin, Kinberg, *Albatross*, Baur and Adams); Abingdon Island (Habel, *Albatross*).

Adult male.—No. 125927, U.S.N.M.; Chatham Island, Galapagos, March 30, 1891; C. H. Townsend. Uniform deep black, most intense anteriorly, the feathers abruptly clear slate-gray beneath the surface;

[1] According to Dr. Sharpe, the type is from Chatham Island.

under tail-coverts broadly margined terminally with light brownish buff; bill entirely deep black; legs and feet dark brown. Length (skin), 4.15; wing, 2.55; tail, 1.58; culmen, 0.55; gonys, 0.30; basal width of mandible, 0.29; basal depth of bill, 0.35; tarsus, 0.75; middle toe, 0.58.

Immature male.—No. 115949, U.S.N.M.; same locality and collector, April 5, 1888. Head, neck, and chest uniform black; back, scapulars, and wings dull black, the feathers margined with grayish olive; rump and upper tail-coverts grayish olive, feathers dusky centrally; tail dusky, the feathers margined with grayish olive; under parts, posterior to chest, blackish, the feathers margined with pale grayish buffy, this color prevailing posteriorly; under tail-coverts pale buffy, each with a central sagittate mark of dusky, mostly concealed. Bill black, the terminal portion of mandible more brownish; legs and feet dusky brown. Length (skin), 4; wing, 2.50; tail, 1.52; culmen, 0.51; gonys, 0.29; basal width of maxilla, 0.26; basal depth of bill, 0.32; tarsus, 0.76; middle toe, 0.55.

Adult female.—No. 125956, U.S.N.M.; Charles Island,[1] Galapagos, April 1, 1891; C. H. Townsend. Above grayish olive, the feathers of the pileum, back, and scapulars with dusky central spots; rump and lower back uniform olive-gray; wings and tail dusky, the feathers margined with olive-gray, except outermost middle and greater wing-coverts, which are more broadly margined terminally with light buffy brown or isabella color. Under parts grayish white, faintly tinged with pale buff, everywhere, except on chin and throat, broadly streaked with dusky; maxilla black, mandible chiefly dusky brown; legs and feet dark brown. Length (skin), 4.15; wing (tips of primaries much worn), 2.50; tail, 1.50; culmen, 0.55; gonys, 0.29; basal width of maxilla, 0.27; basal depth of bill, 0.34; tarsus, 0.78; middle toe, 0.50.

Altogether 116 specimens of this bird have been examined, the localities represented and number of specimens from each being as follows: Chatham Island (42 specimens), Barrington (4), Hood (11), Charles (12), Albemarle (17), Duncan (14), Indefatigable (4), Jervis (3), James (7) and Abingdon (2).

There is the usual amount of variation in this series, but whether there is anything of local significance I am unable to determine, for the reason that the series from the different islands are so unequal in numbers, or at least in the number of adults, and also because nearly one-third of the specimens are not available for comparison, having been returned to Dr. Baur, to whose collection they belong.

Among the specimens from Chatham and Abingdon islands are some young ones which I can not decide whether they should be referred to *G. fuliginosa* or *G. parvula;* in fact, two adult males, one from each island, are doubtful, and I think it can be demonstrated that the line

[1] There is no adult male, or at least none with the sex determined, from Chatham Island in the series before me.

between the two supposed species can not be sharply drawn. There is also a young male from Chatham Island (No. 115950, U.S.N.M.), which is so much larger than other specimens that I am inclined to consider it a hybrid between *G. fuliginosa* and *G. dubia*.

The following measurements of a large series of *G. fuliginosa* are given not only to show the extent to which specimens from the several islands differ, but also for comparison with *G. parvula*, the smallest billed specimens having been selected whenever a particular island was represented by a considerable series. Unfortunately the different islands are represented so unequally that a larger number of specimens could not be selected without impairing the value of the comparison:

Measurements of Geospiza fuliginosa.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Basal depth of bill.	Gonys.	Basal width of mandible.	Tarsus.	Middle toe.
115908	U. S.	Adult male	Charles Island	Apr. 8, 1888	2.53	1.60	.52	.37	.28	.28	.80	.53
125947	U. S.	do	do	Apr. 1, 1891	2.53	1.53	.52	.31	.28	.28	.75	.56
125948	U. S.	do	do	do	2.47	1.62	.49	.35	.25	.26	.78	.53
125949	U. S.	do	do	do	2.55	1.52	.51	.....	.28	.30	.80	.54
125950	U. S.	do	do	do	2.80	1.72	.56	.37	.30	.29	.81	.55
125951	U. S.	do	do	do	2.68	1.60	.54	.37	.30	.30	.80	.55
125952	U. S.	do	do	do	2.50	1.58	.55	.34	.29	.28	.80	.52
125953	U. S.	Immature male	do	do	2.60	1.60	.53	.37	.29	.29	.80	.55
125955	U. S.	do	do	do	2.55	1.57	.52	.33	.25	.26	.78	.51
			Average		2.58	1.57	.52	.35	.28	.28	.78	.53
115979	U. S.	Adult male	Albemarle Island	Apr. 10, 1888	2.47	1.52	.50	.43	.25	.27	.75	.52
115980	U. S.	do	do	do	2.57	1.67	.51	.35	.29	.29	....	.53
149810	U. S.	do	do	do	2.51	1.50	.53	.35	.29	.25	.82	.58
149811	U. S.	do	do	do	2.50	1.57	.48	.32	.24	.23	.79	.55
149812	U. S.	do	do	do	2.48	1.55	.47	.32	.26	.26	.77	.50
149813	U. S.	do	do	do	2.43	1.40	.49	.33	.27	.24	.78	.52
149814	U. S.	Immature male	do	do	2.50	1.50	.49	.30	.26	.25	.78	.56
			Average		2.49	1.53	.49	.34	.26	.26	.78	.54
116004	U. S.	Adult male	James Island	Apr. 11, 1888	2.50	1.52	.50	.31	.26	.28	.75	.51
116005	U. S.	do	do	do	2.55	1.51	.51	.32	.27	.27	.78	.55
			Average		2.53	1.52	.51	.32	.27	.28	.77	.53
116044	U. S.	do	Indefatigable Island.	Apr. 12, 1888	2.48	1.52	.50	.33	.27	.28	.76	.53
116045	U. S.	do	do	do	2.52	1.52	.50	.36	.27	.27	.80	.50
			Average		2.50	1.52	.50	.35	.27	.28	.78	.52
115948	U. S.	Immature male	Chatham Island	Apr. 5, 1888	2.57	1.67	.58	.....	.29	.29	.80	.59
115949	U. S.	do	do	do	2.51	1.43	.52	.34	.29	.29	.78	.57
125921	U. S.	Adult male	do	Mar. 30, 1891	2.57	1.62	.56	.35	.30	.30	.80	.53
125923	U. S.	do	do	do	2.50	1.52	.53	.35	.28	.28	.77	.55
125924	U. S.	do	do	do	2.40	1.45	.53	.33	.28	.28	.75	.52
125925	U. S.	do	do	do	2.60	1.62	.58	.32	.30	.28	.78	.57
125926	U. S.	do	do	do	2.40	1.53	.53	.38	.29	.28	.80	.58
125927	U. S.	do	do	do	2.55	1.60	.54	.35	.30	.28	....	.58
125928	U. S.	do	do	do	2.55	1.65	.55	.38	.30	.28	.80	.58
149809	U. S.	Immature male	do	Apr. 10, 1888	2.50	1.60	.51	.33	.28	.25	.78	....
			Average		2.52	1.57	.54	.35	.29	.28	.78	.56
115884	U. S.	Adult male	Duncan Island	Apr. 13, 1888	2.52	1.60	.48	.38	.26	.27	.78	.55
115885	U. S.	do	do	do	2.52	1.50	.50	.35	.28	.28	.78	.55
115886	U. S.	do	do	do	2.45	1.58	.52	.33	.27	.27	.78	.55
115887	U. S.	do	do	do	2.48	1.47	.50	.33	.25	.27	.78	.57
115888	U. S.	do	do	do	2.50	1.57	.52	.35	.27	.27	.75	.53
115889	U. S.	do	do	do	2.48	1.52	.50	.33	.25	.27	.80	.53

Measurements of Geospiza fuliginosa—Continued.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Basal depth of bill.	Gonys.	Basal width of mandible.	Tarsus.	Middle toe.
115890	U. S.	Adult male	Duncan Island	Apr. 13, 1888	2.48	1.55	.50	.38	.28	.28	.80	.55
125958	U. S.	do	do	do	2.45	1.49	.51	.34	.28	.26	.77	.43
125959	U. S.	Immature male	do	Apr. 2, 1891	2.40	1.49	.49	.33	.27	.27	.73	.49
125960	U. S.	do	do	do	2.40	1.40	.51	.36	.27	.27	.80	.58
			Average		2.47	1.48	.50	.35	.27	.27	.78	.53
116078	U. S.	Adult male	Hood Island	Apr. 7, 1888	2.42	1.48	.53	.34	.27	.27	.75	.60
149832	U. S.	Immature male	do	do	2.39	1.42	.51	.35	.26	.27	.75	.55
149834	U. S.	Adult male	do	do	2.48	1.60	.52	.38	.25	.28	.80	.57
149835	U. S.	Immature male	do	do	2.50	1.50	.52	.32	.28	.27	.75	....
149836	U. S.	do	do	do	2.40	1.50	.49	.32	.24	.24	....	.51
149837	U. S.	do	do	do	(2.35)	1.49	.51	.34	.28	.27	.80	.58
149841	U. S.	Adult male	do	do	2.55	1.45	.53	.37	.28	.28	.81	.55
			Average		2.46	1.49	.51	.35	.27	.27	.78	.56
125954	U. S.	Adult female	Charles Island	Apr. 1, 1891	2.50	(1.45)	.52	.35	.28	.25	.72	.52
125956	U. S.	do	do	do	2.52	1.50	.55	.35	.29	.28	.79	.53
125957	U. S.	do	do	do	2.43	1.50	.50	.30	.29	.26	.73	.52
			Average		2.48	1.50	.52	.33	.29	.26	.75	.52
115981	U. S.	do	Albemarle Island.	Apr. 10, 1888	2.38	1.52	.49	.30	.28	.26	.67	.49
149815	U. S.	do	do	do	2.38	.....	.44	.30	.25	.25	.74	....
149816	U. S.	do	do	do	2.30	1.38	.48	.33	.28	.28	.76	....
149818	U. S.	do	do	do	2.42	1.55	.50	.32	.24	.26	.78	....
			Average		2.37	1.48	.48	.31	.26	.26	.74	.49
115892	U. S.	do	Duncan Island	Apr. 13, 1888	2.46	1.55	.52	.33	.29	.28	.75	.51
115893	U. S.	do	do	do	2.45	1.55	.50	.35	.26	.27	.75	.52
			Average		2.46	1.55	.51	.34	.28	.28	.75	.52
149833	U. S.	do	Hood Island	Apr. 7, 1888	2.37	1.58	.50	.31	.26	.26	.75	.52
149838	U. S.	do	do	do	2.38	1.43	.50	.32	.28	.28	.78	.55
149839	U. S.	do	do	do	2.50	1.52	.50	.31	.26	.27	.77	.51
149840	U. S.	do	do	do	2.33	1.37	.52	.32	.25	.26	.77	.54
			Average		2.40	1.48	.51	.32	.26	.27	.77	.53

GEOSPIZA PARVULA, Gould.

(Plate LVII, fig. 18.)

Geospiza parvula, GOULD, Proc. Zool. Soc., Pt. V, 1837, p. 6 (Galapagos Islands[1]); Zool. Voy. Beagle, III, Birds, 1841, p. 102, pl. XXXIX (James Island).—BONAPARTE, Consp. Av., I, 1850, p. 543.—GRAY, Hand-l., II, 1870, p. 88.—SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Bindloe and Abingdon islands); Nom. Av. Neotr., 1873, p. 27.—SUNDEVALL, Proc. Zool. Soc., 1871, p. 125 (Chatham Island).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 483 (James, Chatham, Bindloe, and Abingdon islands); Cat. Strickl. Coll. 1882, p. 219.—SHARPE, Cat. Birds Brit. Mus., XII, 1888, p. 13 (Chatham, James, Abingdon, and Bindloe islands).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 107 (Abingdon Island).

Specific characters.—Similar to *G. fuliginosa*, Gould, but smaller, with bill more compressed and with straighter outlines; adult males (always?)

[1] Mr. Sharpe designates as the "types of the species" a pair from Chatham Island; but as Mr. Darwin, in the "Zoology of the Beagle" mentions only James Island in connection with the species, I think this is an error. (See also remarks under *Progne modesta*, on p. 505.)

with belly and flanks streaked or intermixed with whitish, and rump grayish olive; adult females plain pale grayish buffy beneath or with only the chest streaked; young (females at least) also plain pale grayish buffy beneath. Wing, about 2.25–2.35; tail, 1.30–1.42; culmen, 0.45–0.48; depth of bill at base, 0.30–0.31; tarsus, 0.70–0.72.

Range.—Galapagos Archipelago: Chatham Island (Kinberg, Townsend); ? Barrington Island (Baur and Adams); ? Indefatigable Island (Baur and Adams); James Island (Darwin); Bindloe Island (Habel); Abingdon Island (Habel, *Albatross*).

Adult (?) *male.*[1]—No. 77755, U.S.N.M.; Abingdon Island, Galapagos, November 15–30, 1868; Dr. A. Habel. Upper parts, head, neck, and chest uniform sooty black, more dusky brown posteriorly, the rump dull grayish olive; rest of under parts sooty blackish, indistinctly streaked with pale buffy grayish, the under tail-coverts buffy white with a central sagittate mark of dusky and the basal half clear slate-gray. Bill wholly black; legs and feet blackish brown. Length (skin), 3.55 (before skinning), 4.50; wing, 2.35; tail, 1.39; culmen, 0.48; gonys, 0.25; basal width of mandible, 0.25; basal depth of bill, 0.31; tarsus, 0.73; middle toe, 0.53.

Younger male.—No. 77754, U.S.N.M.; same locality, etc. Dark grayish brown or sooty, the under parts narrowly streaked with dull brownish white; maxilla brownish black, mandible dark brownish; legs and feet blackish brown. Length (skin), 3.40; wing, 2.25; tail, 1.30; culmen, 0.48; gonys, 0.25; basal width of mandible, 0.25; basal depth of bill, 0.30; tarsus, 0.70; middle toe, 0.53.

Adult female.—No. 115955, U.S.N.M.; Chatham Island, April 5, 1888, C. H. Townsend. Above nearly uniform dull grayish brown, the wing-feathers margined with paler, especially middle and greater coverts; under parts very pale grayish buffy, or buffy grayish white, the chest (only) with a few indistinct streaks of grayish brown; maxilla blackish brown, mandible paler; legs and feet dark horn brown. Length (skin), 3.85; wing, 2.32; tail, 1.42; culmen, 0.45; gonys, 0.23; basal width of mandible, 0.25; basal depth of bill, 0.30; tarsus, 0.72; middle toe, 0.50.

Young female?.—No. 115954, U.S.N.M.; same locality, etc. Essentially like the adult female, but more tinged with buffy olive above and with centers of feathers on pileum and back slightly darker, producing obsolete streaks or spots; under parts wholly immaculate plain pale grayish buffy; bill light brown, the mandible paler; legs and feet deep horn-brown.

There are three other specimens, young birds, from Abingdon Island that are unstreaked pale grayish buffy beneath, and which are therefore unquestionably referable to *G. parvula*; none of them are sexed. There are also six young birds from the same locality that are equally small, but which have the under parts much streaked with dusky (the chin

[1] This specimen is in worn and faded midsummer plumage. Having no specimens from James Island, I am unable to describe examples from the type locality.

and throat almost, sometimes quite, uniformly this color) and the upper parts very much darker. In fact, they resemble exactly in coloration the young of *G. fuliginosa*, but are decidedly smaller. Only one of them has the sex determined, and that is marked "♀." Unless these are unusually small young birds of *G. fuliginosa*, I should be inclined to regard them as all young males of *G. parvula*, notwithstanding the determination of the specimen mentioned; for it looks very much as if the sexual difference in color might, in this form, be as well marked in the young as in the adults.

An adult male from Chatham Island, which seems to be referable to *G. parvula*, has a longer wing and tail than Abingdon Island specimens, but does not otherwise differ in measurements, which are as follows: Length (skin), 3.90; wing, 2.39; tail, 1.45; culmen, 0.47; gonys, 0.25; basal width of mandible, 0.25; basal depth of bill, 0.32; tarsus, 0.72; middle toe, 0.51. In color it resembles the adult (or nearly adult) male from Abingdon Island described above, having the rump dusky olive and the posterior under parts (from upper belly and middle of sides backward) much streaked or intermingled with dull grayish white.

Respecting the occurrence of this form on Barrington and Indefatigable islands, I find among the notes made on the Baur-Adams collection a memorandum to that effect; but as my present understanding of *G. parvula* is somewhat different from what it was at the time the specimens were examined, the specimens (which unfortunately I have not access to at present) should be reexamined.

Measurements of Geospiza parvula.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Basal depth of bill.	Gonys.	Basal width of mandible.	Tarsus.	Middle toe.
77754	U. S.	Immature male	Abingdon Island	Dec. —, ——	2.29	1.32	.50	.34	.27	.27	.71	.53
77755	U. S.	Adult male	do	Nov. —, ——	2.28	1.46	.48	.35	.27	.27	.72	.55
116119	U. S.	do	do	Apr. 16, 1888	2.37	1.52	.51	.34	.28	.28	.70	.50
116120	U. S.		do	do	2.23	1.47	.50	.32	.26	.25	.71	.50
				Average	2.29	1.43	.50	.34	.27	.27	.71	.52
125924	U. S.	Adult male	Chatham Island	Mar. 30, 1891	2.43	1.50	.48	.33	.25	.25	.73	.52
115955	U. S.	Adult female	do	Apr. 5, 1888	2.31	1.45	.45	.31	.24	.25	.73	.50

GEOSPIZA ACUTIROSTRIS, Ridgway.

(Plate LVII, fig. 21.)

Geospiza acutirostris, RIDGWAY, Proc. U. S. Nat. Mus., XVII, No. 1007, Nov. 15, 1894, p. 363 (Tower Island, Galapagos Archipelago; collection of Dr. G. Baur).

Specific characters.—Similar to *G. parvula*, Gould, but bill longer, with straighter outlines, and extremely acute at tip.

Measurements of type.—Wing, 2.45; tail, 1.58; culmen, 0.55; depth of

bill at base, 0.30; tarsus, 0.75; middle toe, 0.53. (Type in Dr. Baur's collection.)

Range.—Galapagos Archipelago: Tower Island (Baur and Adams).

The form of the bill in this species is conspicuously unlike that of any other, being almost exactly that of *Carduelis.*

There are 7 specimens in Dr. Baur's collection, 4 of which are in the black plumage.

GEOSPIZA DENTIROSTRIS, Gould.

Geospiza dentirostris, GOULD, Proc. Zool. Soc., Pt. v, 1837, p. 6 (Galapagos Islands); Zool. Voy. Beagle, III, Birds, 1841, p. 102.—BONAPARTE, Consp. Av., I, 1850, p. 543.—GRAY, Hand-l., II, 1870, p. 88.—SCLATER and SALVIN, Nom. Av. Neotr., 1873, p. 27.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 482 (part) (Charles Island).—SHARPE, Cat. Birds Brit. Mus., XII, 1888, p. 11 (Charles Island, Chatham Island?).

Geospiza fortis (nec GOULD), SALVIN, Proc. Zool. Soc., 1883, p. 421 (part: Charles Island).

Specific characters.—Apparently most like *G. fratercula*, Ridgway, of Abingdon Island, but rather smaller, the bill especially, the latter with the maxillary tomium slightly toothed.

Range.—Galapagos Archipelago: Charles Island (Markham); ? Chatham Island (fide Sharpe).

"*Adult male.*—Similar to the male of *G. fortis*,[1] but with a differently shaped bill, bowed in toward the end of the upper mandible, and slightly toothed on its cutting edge. Total length, 4.5 inches; culmen, 0.55; wing, 2.65; tail, 1.45; tarsus, 0.75.

"*Adult female* (type of species).—Similar to the female of *G. fortis*, but differing in the form of the bill. Total length, 4.9 inches; culmen, 0.6; wing, 2.65; tail, 1.55; tarsus, 0.75." (Sharpe.)

I have never seen a specimen of this apparently very distinct species.

GEOSPIZA DIFFICILIS, Sharpe.

(Plate LVII, fig. 20.)

Geospiza dentirostris (nec GOULD), SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Abingdon Island).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 483 (Abingdon Island).

??*Geospiza fortis* (nec GOULD), SALVIN, Proc. Zool. Soc., 1883, p. 421 (part: Charles Island).

Geospiza difficilis, SHARPE, Cat. Birds Brit. Mus., XII, 1888, p. 12 (Abingdon Island, Galapagos Archipelago; collection Brit. Mus.; "Charles Island").—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 107 (Abingdon Island).

Specific characters.—Similar to *G. fuliginosa*, Gould, in general dimensions, but bill very different in form, being more elongated, culmen straighter with basal portion distinctly elevated and arched, nasal

[1] Mr. Sharpe's *G. fortis* included Abingdon Island specimens which I have recently separated as *G. fratercula.*

fossæ much larger, and maxillary tomium more distinctly lobed or convex in middle portion. Female much darker than in any allied forms.

Range.—Galapagos Archipelago: ??Charles Island (Markham); Abingdon Island (Habel, Townsend).

Adult male.—No. 116117, U.S.N.M.; Abingdon Island, Galapagos, April 16, 1888; C. H. Townsend. Entirely uniform deep black, the feathers abruptly clear slate-gray beneath the surface; bill wholly deep black; legs and feet brownish black. Length (skin), 4.55; wing, 2.43; tail, 1.50; culmen, 0.58; gonys, 0.31; basal width of mandible, 0.28; basal depth of bill, 0.37; tarsus, 0.80, middle toe, 0.53.

Adult (?) female.—No. 116118, U.S.N.M.; same locality, etc. Above dull grayish dusky (inclining to grayish or olivaceous black on head and neck), the feathers margined with olivaceous; beneath dusky slate, nearly uniform anteriorly, but feathers everywhere margined with light buffy olive, most broadly on under parts of the body, especially posteriorly, where nearly uniform on belly and flanks; under tail-coverts light brownish buffy, tinged with olive, each with a central longitudinal spot of dusky. Bill, legs, and feet brownish black. Length (skin), 4.75; wing, 2.35; tail, 1.45; culmen (tip of maxilla broken); gonys, 0.29; basal width of mandible, 0.24; tarsus, 0.80; middle toe, 0.54.

I doubt the correctness of the identification, or the locality, of the Charles Island specimen collected by Captain Markham.

GEOSPIZA DEBILIROSTRIS, Ridgway.

(Plate LVII, fig. 19.)

Geospiza debilirostris, RIDGWAY, Proc. U. S. Nat. Mus., XVII, No. 1007, Nov. 15, 1894, p. 363 (James Island, Galapagos Archipelago; collection U. S. Nat. Mus.).

Specific characters.—Similar to *G. fortis*, Gould, in size, but feet larger and stouter, and bill conspicuously smaller.

Range.—Galapagos Archipelago: James Island (*Albatross*).

Adult male.—Type, No. 116003, U.S.N.M.; James Island, Galapagos, April 11, 1888; C. H. Townsend. Entirely uniform deep black (less intense posteriorly), the feathers abruptly clear slate-gray beneath the surface; lower part of abdomen intermixed with buffy whitish, and longer under tail-coverts broadly margined terminally with the same, tinged with light rusty; bill wholly deep black; legs and feet brownish black. Length (skin), 4.90; wing, 2.93; tail, 1.70; culmen, 0.60; gonys, 0.30; basal width of mandible, 0.30; basal depth of bill, 0.37; tarsus, 0.95; middle toe, 0.67.

Of this apparently very distinct species I have seen but one specimen. Although the general dimensions are nearer those of *G. fortis* than any other form of the genus, the bill is scarcely larger than in *G. fuliginosa*, and has exactly the same form as in that species.

GEOSPIZA SCANDENS (Gould).

(Plate LVII, fig. 2.)

Cactornis scandens, GOULD, Proc. Zool. Soc., Pt. v, 1837, p. 7 (Galapagos Islands); Zool. Voy. Beagle, III, Birds, 1841, p. 104, pl. 42 (James Island).—BONAPARTE, Consp. Av., I, 1850, p. 542.—GRAY, Hand-l., II, 1870, p. 89.—SUNDEVALL, Proc. Zool. Soc., 1871, p. 124 (part: James Island).—SCLATER and SALVIN, Nom. Av. Neotr., 1873, p. 29.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 485 (part: James Island).—SHARPE, Cat. Birds Brit. Mus., XII, 1888, p. 19 (part: James Island).

G[eospiza] scandens, RIDGWAY, Proc. U. S. Nat. Mus., XVII, 1894, p. 361 (in text).

[*Tisserin de Gallapagos*, NÉBOUX, Rev. Zool., 1840, p. 291.—*Cactornis grimpeur*, PRÉVOST et DES MURS, Voy. Vénus, Ois., 1855, p. 204.]

Specific characters.—Bill elongate-conical, with its basal depth much less than the length of the gonys, and the basal width of the mandible (across chin) still less; culmen slightly convex, nearly straight in middle portion, scarcely arched basally, and not more than 0.72 (usually about 0.70) in length; basal depth of bill, 0.33–0.37; basal width of mandible, 0.28–0.31; wing, 2.65–2.80; tail, 1.58–1.79; tarsus, 0.80–0.85.

Range.—Galapagos Archipelago: James Island (Darwin, Kinberg, Baur and Adams).

Adult male.—No. 542, collector Dr. G. Baur; James Island, Galapagos, August 16, 1891. Entirely uniform deep black; bill wholly deep black; legs and feet brownish black; "iris dark brown." Length (skin), 4.35; wing, 2.70; tail, 1.62; culmen, 0.70; gonys, 0.40; width of mandible at base, 0.28; depth of bill at base, 0.34; tarsus, 0.83; middle toe, 0.58.

Immature male.—No. 572, U.S.N.M.; same collection, etc., August 17. Head and neck dull blackish, slightly broken on chin and throat by a few narrow whitish streaks; postocular region, hind neck, and upper parts dull grayish olive (more decidedly olivaceous on lower back and rump), the feathers of the back extensively blackish centrally, producing a spotted appearance; wings and tail dusky, the feathers with grayish olive margins, the middle and greater wing-coverts conspicuously margined terminally with pale brownish buffy, and the primaries narrowly edged with light olive-grayish; under parts, posterior to throat, pale olive-buffy, tinged with pale brownish laterally, the feathers of the chest, upper breast, sides, and flanks with broad central spots of dusky, larger and more distinct anteriorly; under tail-coverts with rather indistinct central spots of grayish; bill wholly deep black; legs and feet brownish black; "iris dark brown." Length (skin), 4.70; wing, 2.80; tail, 1.79; culmen, 0.72; gonys, 0.40; width of mandible at base, 0.30; depth of bill at base, 0.35; tarsus, 0.83; middle toe, 0.62.

Adult female.—No. 554, U.S.N.M.; same collection, etc., August 16. Similar to the immature male described above, but head grayish olive, streaked with dusky, the chin and throat narrowly streaked with buffy grayish white and dusky; under parts more strongly tinged with light

buffy brown, with spots on breast, etc., narrower and rather less distinct; light terminal margins to wing-coverts broader and more cinnamomeous, especially those on middle coverts; mandible black only on upper basal portion, the rest dark purplish brown; "iris brown." Length (skin), 4.30; wing, 2.65; tail, 1.58; culmen, 0.71; gonys, 0.40; width of mandible at base, 0.30; depth of bill at base, 0.36; tarsus, 0.82; middle toe, 0.59.

Young male.—No. 523, U.S.N.M.; same collection, etc., August 13. Similar to the immature male (No. 572) described above, but margins of wing-coverts dull buffy, and bill light colored, the maxilla dark brown basally, paler terminally and on culmen, the mandible pale brownish buffy with a deep brown patch along deflected portion of the tomium. Length (skin), 4.60; wing, 2.65; tail, 1.65; culmen, 0.70; gonys, 0.40; width of mandible at base, 0.30; depth of bill at base, 0.35; tarsus, 0.84; middle toe, 0.65.

This form, which is peculiar to James Island, is the smallest member of the subgenus *Cactornis*, and has the bill not only distinctly smaller than in any other form but with straighter outlines. There are eight specimens in Dr. Baur's collection, their measurements being as follows:

Measurements of Geospiza scandens.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Gonys.	Basal width of mandible.	Basal depth of bill.	Tarsus.	Middle toe.
523	B. & A.	Young male	James Island	Aug. 13, 1891	2.65	1.65	.70	.40	.30	.35	.84	.65
542	B. & A.	Adult male	do	Aug. 16, 1891	2.70	1.62	.70	.40	.28	.34	.83	.58
548	B. & A.	do	do	do	2.80	1.72	.70	.40	.30	.37	.85	.59
555	B. & A.	do	do	Aug. 17, 1891	2.65	1.70	.70	.39	.30	.35	.80	.61
566	B. & A.	do	do	do	2.03	1.60	.70	.39	.30	.37	.84	.58
568	B. & A.	do	do	do	2.72	1.63	.71	.40	.30	.36	.81	.60
572	B. & A.	Immature male	do	do	2.80	1.79	.72	.40	.31	.33	.83	.62
			Average		2.71	1.67	.70	.40	.30	.35	.83	.60
554	B. & A.	Adult female	James Island	Aug. 16, 1891	2.65	1.58	.71	.40	.30	.36	.82	.59

GEOSPIZA INTERMEDIA, Ridgway.

(Plate LVII, fig. 3.)

Cactornis scandens (nec GOULD), SUNDEVALL, Proc. Zool. Soc., 1871, p. 124 (part: Charles Island).—SALVIN, Trans. Zool. Soc. Lond., IX, Pt. IX, 1876, p. 485 (part: Charles Island).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 108 (part: Charles Island).

Geospiza intermedia, RIDGWAY, Proc. U. S. Nat. Mus., XVII, No. 1007, Nov. 15, 1894, p. 361, in text, sub *G. assimilis* (Charles Island, Galapagos Archipelago; collection U. S. Nat. Mus.).

Specific characters.—Similar to *G scandens* (Gould), of James Island, but with larger and stouter bill. Culmen, 0.75–0.79; basal depth of

bill, 0.35–0.40; basal width of mandible, 0.29–0.32; wing, 2.62–2.80; tail, 1.59–1.75; tarsus, 0.82–0.83.

Range.—Galapagos Archipelago: Charles Island (Nêboux, Kinberg, Townsend, Baur and Adams).

Adult male.—Type, No. 115916, U.S.N.M.; Charles Island, Galapagos, April 8, 1888; C. H. Townsend. Entirely uniform deep black, less intense or tinged with olive-slaty, posteriorly, the feathers abruptly clear slate-gray beneath the surface; longer under tail coverts margined terminally with white; bill black, middle portion of mandible underneath, tinged with brown; legs and feet brownish black. Length (skin), 5.35; wing, 2.75; tail, 1.72; culmen, 0.75; gonys, 0.41; basal width of mandible, 0.32; basal depth of bill, 0.39; tarsus, 0.82; middle toe, 0.60.

Younger male.—No. 125962, U.S.N.M.; same locality and collector, April 1, 1891. Dull black, uniform only on head, neck, and chest, the feathers of upper parts margined with grayish olive, indistinctly on back, most conspicuously on rump; feathers of under parts, posterior to chest, margined with pale buffy grayish or olive-whitish, the latter prevailing on center of abdomen and on under tail-coverts; bill, legs, and feet as in perfectly adult male. Length (skin), 5.30; wing, 2.80; tail, 1.78; culmen, 0.78; gonys, 0.41; basal width of mandible, 0.29; basal depth of bill, 0.38; tarsus, 0.83; middle toe, 0.59.

Immature male.—No. 125964, U.S.N.M.; same locality, etc. Above dusky, nearly uniform on pileum, elsewhere broken by olive-grayish margins to the feathers, the middle and outermost greater wing-coverts distinctly margined with pale grayish buffy; sides of head sooty grayish, finely and indistinctly streaked with dusky and dull grayish buffy; chin, throat, and chest blackish dusky, broken by occasional edgings of pale grayish buffy; rest of under parts broadly striped with dusky and pale grayish buffy, the latter prevailing posteriorly; bill wholly black; legs and feet blackish brown. Length (skin), 5.10; wing, 2.75; tail, 1.75; culmen, 0.79; gonys, 0.45; basal width of mandible, 0.32; basal depth of bill, 0.40; tarsus, 0.82; middle toe, 0.60.

Adult female.—No. 125965, U.S.N.M.; same locality, etc. Similar to the immature male described above (No. 125964, U.S.N.M.), but anterior under parts much more broadly streaked with dull whitish; mandible largely light brownish. Length (skin), 4.90; wing, 2.78; tail, 1.59; culmen, 0.79; gonys, 0.42; basal width of mandible, 0.31; basal depth of bill, 0.38; tarsus, 0.85; middle toe, 0.64.

Immature female.—No. 115918, U.S.N.M.; same locality and collector, April 8, 1888. Similar to the adult female, as described, but feathers of upper surface more distinctly margined with a more distinctly olivaceous hue, the middle and greater wing-coverts broadly margined terminally with brownish buff; under parts strongly suffused with pale olive-buffy; mandible dark brownish, becoming black basally. Length (skin), 4.95; wing, 2.62; tail, 1.65; culmen, 0.77; gonys, 0.43; basal width of mandible, 0.30; basal depth of bill, 0.35; tarsus, 0.83; middle toe, 0.58.

Measurements of Geospiza intermedia.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Basal depth of bill.	Gonys.	Basal width of mandible.	Tarsus.	Middle toe.
115916	U. S.	Adult male	Charles Island	Apr. 8, 1888	2.75	1.73	.73	.41	.41	.34	.85	.64
115917	U. S.	do	do	do	2.83	1.83	.83	.....	.47	.31	.88	.60
125962	U. S.	do	do	Apr. 1, 1891	2.83	1.80	.78	.40	.43	.30	.85	.58
125963	U. S.	Immature male?.	do	do	2.68	1.54	.78	.39	.42	.31	.86	.59
125964	U. S.	Immature male.	do	do	2.78	1.75	.80	.40	.47	.31	.82	.58
			Average		2.77	1.73	.78	.40	.44	.32	.85	.60
115918	U. S.	Immature female.	Charles Island	Apr. 8, 1888	2.62	1.65	.77	.38	.42	.30	.85	.58
115919	U. S.	Adult female	do	do	2.86	1.72	.80	.....	.43	.30	.89	.66
125965	U. S.	Immature female.	do	Apr. 1, 1891	2.82	1.60	.75	.40	.40	.31	.82	.65
			Average		2.83	1.66	.77	.39	.42	.30	.85	.63

GEOSPIZA ASSIMILIS (Gould).

Cactornis assimilis, GOULD, Proc. Zool. Soc., Pt. v, 1837, p. 7 (Galapagos Islands); Zool. Voy. Beagle, III, Birds, 1841, p. 105, pl. XLIII.—BONAPARTE, Consp. Av., I, 1850, p. 542.—GRAY, Hand-l., II, 1870, p. 323.—SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Bindloe Island); Nom. Av. Neotr., 1873, p. 29.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 486 (Bindloe Island).—SHARPE, Cat. Birds Brit. Mus., XII, 1888, p. 18 (Bindloe Island).

Specific characters.—Adult male unknown,[1] but immature male and adult female apparently differing from those of *G. scandens* in larger size.

Range.—Galapagos Archipelago: ? James Island (Baur and Adams); Bindloe Island (Habel, fide Salvin).

Immature male.—"General color above blackish, slightly varied with ashy olive margins to the feathers, especially on the lower back, rump, and upper tail-coverts; lesser wing-coverts like the back; median and greater coverts blackish, with sandy margins to the feathers; bastard wing, primary coverts, and quills blackish, narrowly edged with ashy olive, the primaries margined with hoary gray; tail feathers blackish brown, edged with paler brown externally, and with sandy brown near the tips of the inner webs; head and neck rather browner than the back, the sides of the face, ear-coverts, throat, and breast blackish brown, the latter slightly mottled with sandy brown edges; center of abdomen buffy whitish, strongly mottled with blackish brown centers to the feathers; sides of body, flanks, and thighs blackish brown, washed with ashy brown; under tail-coverts blackish brown, conspicuously edged with buffy whitish; under wing-coverts and axillaries blackish

[1]Dr. Sharpe describes what he calls the adult male, but the specimen which he describes (the type) is evidently an immature bird. His description is quoted under the heading "Immature male."

brown, edged with ashy olive. Total length, 5 inches; culmen, 0.9; wing, 2.75; tail, 1.4; tarsus, 0.95.

"*Adult female.*—Similar to the male. Total length, 5 inches; culmen, 0.85; wing, 2.75; tail, 1.5; tarsus, 0.85." (Sharpe.)

Without having seen specimens of this form, I am unable to state just how much it differs from *G. intermedia* and other local races.

Upon what grounds Messrs. Sclater and Salvin, and after them Dr. Sharpe, identify the Bindloe Island *Cactornis* with *C. assimilis*, Gould, we are not informed. Even Darwin did not know where the type came from, though he says "almost certainly not from James Island."[1]

There is in Dr. Baur's collection a young male from James Island (No. 527, August 13, 1891) which is certainly not *G. scandens*, but is either *G. assimilis* or an undescribed form. It is decidedly larger than any of the eight examples of *G. scandens* with which I have compared it, the bill especially being much larger and deeper, with decidedly curved culmen. These differences are the more important from the fact that the bird is a very young one, in nestling plumage. The coloration is much darker than in any of the immature stages of *G. scandens*, the under parts being mostly dark sooty grayish distinctly intermixed with whitish only on the abdominal region and under tail-coverts, and the upper parts are quite uniform dark sooty, except the wings, which have the usual lighter margins, though these are distinct only on the middle and greater coverts. The bill is a light buffy brown, dusky at the extreme tip and deeper brown basally. In coloration this James Island specimen very closely resembles a young male of corresponding age of *G. abingdoni*, except that in the latter the maxilla is almost wholly blackish brown, and the mandibular rami have a sharply defined oblique spot of the same color at their upper basal portion; but the shape of the bill is quite different, that of *G. abingdoni* being much more slender.

The presumed young male of *G. assimilis*, mentioned above, may be more exactly described as follows:

Young male.—No. 527, collection of Dr. G. Baur; James Island, Galapagos, August 13, 1891. Above uniform sooty blackish, the middle wing-coverts and remiges narrowly margined with dull grayish buffy, becoming more decidedly grayish on primaries; greater wing-coverts more broadly margined (especially at tips) with a more pronounced buffy tint; under parts more grayish dusky than upper surface, nearly uniform as far back as chest, elsewhere, especially on abdomen, broken by irregular streaks of dull grayish white; bill pale buffy brown, deeper brown on basal half of maxilla (except on culmen) and along deflected portion of the mandibular tomium; legs and feet blackish brown; "iris dark brown." Length (skin), 5; wing, 2.85; tail, 1.80; culmen, 0.80; gonys, 0.46; width of mandible at base, 0.35; depth of bill at base, 0.42; tarsus, 0.90; middle toe, 0.68.

[1] Zoology of the Beagle, Birds, p. 105.

GEOSPIZA FATIGATA, Ridgway.

Cactornis scandens (nec GOULD), SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Indefatigable Island).—SALVIN, Trans. Zool. Soc. Lond., IX, Pt. IX, 1876, p. 485 (part: Indefatigable Island).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 108 (part: Indefatigable Island).

Geospiza assimilis (nec *Cactornis assimilis*, GOULD), RIDGWAY, Proc. U. S. Nat. Mus., XVII, 1894, p. 361 (Indefatigable Island; Albemarle and Jervis islands?).

Geospiza fatigata, RIDGWAY, Proc. U. S. Nat. Mus., XVIII, No. 1067, April 23, 1896, p. 293 (Indefatigable Island, Galapagos Archipelago; U. S. Nat. Mus.).

Specific characters.—Similar to *G. intermedia*, Ridgway, from Charles Island, but slightly larger, with the bill, legs, and toes decidedly longer. Wing, 2.65–2.82; tail, 1.65–1.73; culmen, 0.82–0.89; basal depth of bill, 0.40; basal width of mandible, 0.35–0.39; tarsus, 0.85–0.90.

Range.—Galapagos Archipelago: ?Albemarle Island (Baur and Adams); ??Chatham Island (Baur and Adams); Indefatigable Island, (Habel, *Albatross*, Baur and Adams); ?Jervis Island (Baur and Adams).

Adult male.—Type, No. 116048, U.S.N.M.; Indefatigable Island, Galapagos, April 12, 1888; C. H. Townsend. Entirely uniform black, deepest anteriorly;[1] bill wholly deep black; legs and feet dark brownish. Length (skin), 5.35; wing, 2.82; tail, 1.70; culmen, 0.82; gonys, 0.48; basal width of mandible, 0.35; basal depth of bill, 0.40; tarsus, 0.88; middle toe, 0.65.

Immature male.—No. 116050, U.S.N.M.; same locality, etc. Head and neck nearly uniform grayish dusky; rest of upper parts similar, but feathers broadly margined with dull brownish gray, this color nearly uniform on rump; under parts, posterior to throat, with feathers dusky centrally and dull grayish white on margins, the former color prevailing anteriorly, the latter posteriorly; bill wholly black; legs and feet brownish black. Length (skin), 5.30; wing, 2.80; tail, 1.73; culmen, 0.89; gonys, 0.50; basal width of mandible, 0.35; basal depth of bill, 0.40; tarsus, 0.90; middle toe, 0.65.

Adult female.—No. 116051, U.S.N.M.; same locality, etc. Similar to the immature male described above, but upper parts more tinged with olive and the lighter color of the under parts tinged with pale dull buff; mandible dark brown, blackish at base. Length (skin), 5.35; wing, 2.65; tail, 1.65; culmen, 0.82; gonys, 0.47; basal width of mandible, 0.39; basal depth of bill, 0.40; tarsus, 0.85; middle toe, 0.61.

The specific name selected for this form has no reference to the name of the island where the bird occurs, but was suggested by the tedious character of the work involved in discriminating the forms of this difficult subgeneric group.

The only "*Cactornis*" that I have seen from Chatham Island is a young male (No. 115941, U.S.N.M.; Chatham Island, April 5, 1888; C. H.

[1] The under tail-coverts are wanting, but in other specimens are broadly margined with whitish, as in related forms.

Townsend), in nestling plumage (though full grown). It may be referable to the present form, but is just as likely to belong to a different one, adult specimens being necessary to determine the question.

Whether Albemarle and Jervis islands specimens really belong here I am unable to decide, not having specimens at hand.

Measurements of Geospiza fatigata.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Basal depth of bill.	Gonys.	Basal width of mandible.	Tarsus.	Middle toe.
116046	U. S.	Adult male ...	Indefatigable Island.	Apr. 12, 1888	2.90	1.68	.81	.39	.43	.31	.88	.62
116047	U. S.	.....do	.....do	.....do	2.80	1.73	.89	.39	.51	....	.88	.66
116048	U. S.	.....do	.....do	.....do	2.83	1.50	.83	.41	.46	.35	.85	.65
116049	U. S.	Immature male	.....do	.....do	2.78	1.70	.80	....	.42	.32	.84	.64
116050	U. S.	.....do	.....do	.....do	2.81	1.75	.84	.40	.48	.35	.90	.68
			Average....	.....	2.82	1.61	.85	.40	.46	.33	.87	.65
116051	U. S.	Adult female..	Indefatigable Island.	Apr. 12, 1888	2.62	1.61	.85	.41	.47	.31	.85	.62

GEOSPIZA ABINGDONI, Sclater and Salvin.

(Plate LVII, fig. 5.)

Cactornis abingdoni, SCLATER and SALVIN, Proc. Zool. Soc., 1870, pp. 323, 326 (Abingdon Island, Galapagos Archipelago); Nom. Av. Neotr., 1873, p. 29.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 486 (Abingdon Island).—SHARPE, Cat. Birds Brit. Mus., XII, 1888, p. 20 (Abingdon Island).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 108 (Abingdon Island).

G[eospiza] abingdoni, RIDGWAY, Proc. U. S. Nat. Mus., XVII, 1864, p. 361, in text.

Specific characters.—Similar to *G. fatigata*, Ridgway, of Indefatigable Island, but still larger, and the bill much deeper, with culmen more arched and sharply ridged. Adult male: Length (skins), 5–5.55; wing, 2.68–2.92; tail, 1.55–1.77; culmen, 0.80–0.88; gonys, 0.43–0.48; basal width of mandible, 0.32–0.33; basal depth of bill, 0.39–0.45; tarsus, 0.89–0.92; middle toe, 0.65–0.68.

Range.—Galapagos Archipelago: Abingdon Island (Habel; Townsend).

Adult male.—No. 116126, U.S.N.M.; Abingdon Island, April 16, 1888; C. H. Townsend. Uniform black, rather duller or more tinged with grayish on under parts, especially posteriorly; under tail-coverts light gray basally and broadly margined for exposed portion with light buffy, with a large cordate or ovate blackish area between. Bill and feet entirely black. Length (skin), 5.55; wing, 2.88; tail, 1.77; culmen, 0.88; gonys, 0.48; basal width of mandible, 0.33; basal depth of bill, 0.45; tarsus, 0.90; middle toe, 0.68.

Immature male.—No. 116129, U.S.N.M.; same locality, etc. Above dull black, the feathers, except on head and neck, margined with dull

olive, the middle and greater wing-coverts margined terminally with brownish buff; sides of head, chin, and throat plain dull black, like pileum; chest and upper breast the same, but feathers margined with light olive-buff, producing a squamate appearance; rest of under parts dull buffy grayish olive, the feathers with more or less of a dusky central area (most distinct on lower breast), the middle of the abdomen plain pale dull buffy. Maxilla brownish black, with a lighter colored subterminal space; mandible light yellowish brown, with the tip and an oblique space at the lateral base, parallel with the basal deflection of the tomium, dusky; legs and feet black. Bill smaller than in the adult. Length (skin), 5; wing, 2.68; tail, 1.55; culmen, 0.80; gonys, 0.43; basal width of mandible, 0.32; basal depth of bill, 0.40; tarsus, 0.89; middle toe, 0.65.

Young male.—No. 116128, U.S.N.M.; same locality, etc. Essentially like the immature male described above, but texture of plumage very different, and the dusky coloring more uniform, especially on chin, throat, and chest, where quite unbroken.

GEOSPIZA BARRINGTONI, Ridgway.

(Plate LVII, fig. 4.)

Geospiza barringtoni, RIDGWAY, Proc. U. S. Nat. Mus., XVII, No. 1007, Nov. 15, 1894, p. 361 (Barrington Island, Galapagos Archipelago; collection of Dr. G. Baur).

Specific characters.—Similar to *G. abingdoni*, Sclater and Salvin, of Abingdon Island, but bill much stouter, with its tip less compressed and less acute. Wing, 2.70–2.80; tail, 1.58–1.62; culmen, 0.79–0.80; tarsus, 0.90; middle toe, 0.70. (Type, No. 596, collection of Dr. G. Baur, male adult; Barrington Island, July 9, 1891.)

Range.—Galapagos Archipelago: Barrington Island (Baur and Adams).

Dr. Baur's collection contains three specimens of this form, two adult males and one in the streaked plumage.

I regret being unable to give a more detailed description of this form.

GEOSPIZA BREVIROSTRIS, Ridgway.

(Plate LVII, fig. 6.)

Cactornis brevirostris, RIDGWAY, Proc. U. S. Nat. Mus., XII, No. 767, Feb. 5, 1890, p. 108, fig. 4 (Chatham Island, Galapagos Archipelago; collection U. S. Nat. Mus.).

Specific characters.—Similar to *G. barringtoni*, Ridgway, of Barrington Island, but tail longer, bill much shorter and stouter, and tarsi shorter. Wing, 2.70–2.80; tail, 1.65–1.85; culmen, 0.70–0.72; basal width of mandible, 0.37; basal depth of bill, 0.42–0.45; tarsus, 0.82–0.87.

Range.—Galapagos Archipelago: Charles Island (*Albatross*; ? Indefatigable Island; Habel).

Immature male.—Type, No. 115920, U.S.N.M.; Charles Island, Galapagos, April 8, 1888; U. S. S. *Albatross*. Dull sooty blackish, uniform on head, neck, and chest, elsewhere broken by lighter margins to feathers; these edgings dull light grayish brown on upper parts, dull brownish white on lower parts; sides and flanks washed with pale brown; under tail-coverts dull buffy white, with concealed mesial streaks of dusky. Bill entirely black; tarsi deep brown; toes brownish black. Length (skin), 4.50; wing, 2.70; tail, 1.85; culmen, 0.72; maxilla from nostril, 0.50; gonys, 0.40; basal width of mandible, 0.37; basal depth of bill, 0.45; tarsus, 0.82; middle toe, 0.62.

I refer, with some doubt, to this species a bird from Indefatigable Island (No. 77756, U.S.N.M.; Indefatigable Island, August 10, 1868; Dr. A. Habel). It is apparently an adult female, with wholly light cinnamon-colored bill and streaked plumage, lacking the buffy margins of the middle and greater wing-coverts and other features which characterize young birds in their first year. It certainly can not be referred to the ordinary "*Cactornis*" of the same island, which has the bill altogether longer and at the same time much narrower in both its vertical and transverse diameters. The size and shape of the bill agree very closely with those of *G. brevirostris*, though, as might be expected from the difference in age or sex, it is not quite so strong.

Fig 5. Head of *Geospiza brevirostris*.

The specimen in question may be described as follows:

?*Adult female.*—No. 77756, U.S.N.M.; Indefatigable Island, August 10, 1868; Dr. A. Habel. Above dusky, all the feathers margined with grayish olive, this color prevailing (almost uniform, in fact) on the rump; middle and greater wing-coverts margined terminally with a rather more buffy or light brownish hue, but still not approaching tawny or rusty; sides of head, chin, and throat dusky or dull blackish brown, faintly streaked with dull whitish, more distinctly along the median line; rest of under parts dull buffy white, immaculate on middle of abdomen, elsewhere broadly streaked with dusky, the streaks giving way on sides and flanks to a nearly uniform light olive. Bill wholly clear deep cinnamon, paler on lower and terminal portions of mandible; legs and feet brownish black. Length (skin), 3.80; wing, 2.80; tail, 1.65; culmen, 0.70; maxilla from nostril, 0.50; gonys, 0.40; basal width of mandible, 0.37; basal depth of bill, 0.42; tarsus, 0.87; middle toe, 0.62.

The form of the bill in this species is exactly intermediate between that of "*Cactornis*" *scandens* and that of the medium-sized true *Geospizæ*, as *G. fortis*, *G. dubia*, etc. Possibly it is a hybrid.

GEOSPIZA PROPINQUA, Ridgway.

(Plate LVII, fig. 7.)

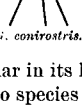
Geospiza propinqua, RIDGWAY, Proc. U. S. Nat. Mus., XVII, No. 1007, Nov. 15, 1894, p. 361 (Tower Island, Galapagos Archipelago; collection of Dr. G. Baur).

Specific characters.—Very similar to *G. conirostris*, Ridgway, of Hood Island, in size and general form, but bill still narrower, with the culmen more convex terminally, and the mandible relatively narrower and more compressed; wing slightly shorter. Wing, 2.95–3.15; tail, 1.85–1.95; culmen, 0.82–0.90; width of mandible across rami 0.23–0.26, of maxilla in front of nostrils 0.22–0.26; tarsus, 0.90–0.95; middle toe, 0.68–0.75.

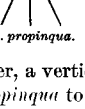
Range.—Galapagos Archipelago: Tower Island (Baur and Adams).

Adult male.—Type, No. 597, collection of Dr. G. Baur; Tower Island, September 2, 1891. Entirely black, with the plumage abruptly slate-gray basally; bill blackish, the mandible inclining to dusky horn gray; legs and feet dusky. Wing, 3.10; tail, 1.90; culmen, 0.85; width of mandibular rami, 0.23; width of maxilla in front of nostril, 0.23; tarsus, 0.95; middle toe, 0.68.

This form so closely resembles *G. conirostris* that at first I was inclined to consider it the same, notwithstanding the wide separation of the two localities. A closer examination, however, disclosed the fact that while in the Hood Island specimens the under mandible is decidedly broader at the angle than the upper, the Tower Island specimens have the two mandibles of practically equal width. Thus, considering the lateral profile of the bill as a cone, and the culmen as representing the right-hand margin, the commissure would in *G. conirostris* intersect the cone obliquely so as to throw the broader section to the left, while in *G. propinqua* the line would be exactly vertical, thus dividing the cone into two equal sections. Diagrammatically, the difference may be expressed thus:



G. conirostris.



G. propinqua.

While so similar in its lateral aspect, however, a vertical view of the bills of these two species shows that of *G. propinqua* to be much more compressed than that of *G. conirostris*, the width of the mandible between the base of the rami being much less than the length of the gonys, instead of just the same, thus throwing *G. propinqua* on the "*Cactornis*" side of the line.

Adult males of this species have very much less black on the under tail coverts than those of *G. conirostris*. In the latter, these feathers are black with white margins, while in *G. propinqua* they are light buff with a median wedge-shaped mark of black.

The type has the mandible dusky, though not so dark as the maxilla, the color approaching more nearly a dusky horn gray. In the other four adult males, however, the bill is lighter colored, the maxilla being dusky brown and the mandible varying from yellowish horn color to light yellow.

Genus CAMARHYNCHUS, Gould.

Camarhynchus, GOULD, Proc. Zool. Soc., Pt. v, 1837, p. 6. Type, *C. psittacula*, Gould.

Generic characters.—Bill short, deep, and broad, long, narrow and compressed, or variously intermediate between these extremes, but the culmen always distinctly curved and the maxilla at least as deep as the mandible, with its tomium varying from nearly straight (*C. psittaculus*, etc.) to strongly angulated (*C. variegatus*). Nostril very small, circular or oval, exposed. Rictal bristles obsolete. Wing about three times as long as tarsus, rounded (first quill equal to or longer than sixth); primaries exceeding secondaries by more than length of maxilla from nostril. Tail not more than twice as long as tarsus, slightly rounded. Middle toe with claw nearly as long as tarsus. Coloration: Above nearly plain olivaceous; beneath dull whitish or pale buff-yellowish, with or without darker streaks on chest, etc., the adult males of some species with head, neck, and chest blackish.

Range.—Peculiar to the Galapagos Archipelago.

This genus comes very near to *Geospiza*, from which it differs chiefly in the form of the bill, which is more compressed, has the culmen (in most species) far more convex, and the gonydeal angle much more prominent. The commissure is also straighter, except in *C. variegatus*, which species very nearly obliterates the gap between typical *Camarhynchus* and such tumid-billed *Geospizæ* as *G. dubia*. *C. variegatus*, in fact, represents one extreme of a nearly unbroken transitional series, the opposite extreme of which is represented by *C. pallidus*. The latter was originally referred to "*Cactornis*," and has been allowed to remain in that so-called genus; but the transition in the form of the bill from *C. pallidus* to *C. psittaculus* through such intermediate species as *C. productus* and *C. compressirostris* is so nearly complete, the plumage being at the same time identical, that I am disposed to refer this long-billed species to *Camarhynchus* rather than to make a new genus for its reception, together with the related *C. productus*. Certainly these two species do not belong to *Cactornis*, which is to *Geospiza* exactly what *C. pallidus* and *C. productus* are to true *Camarhynchus*. In case it be deemed expedient to make a new genus for *C. pallidus* and *C. productus*, it will then be quite necessary to make another one for *C. variegatus*, between which and any other species of the group (except perhaps *C. crassirostris*, Gould, which I have not seen) there is a more definite break than between any of those which are left after its exclusion. Indeed, I find myself quite unable to give precise characters for the genus, the varia-

tions in the form of the bill, both in this group and in *Geospiza*, being very largely a specific character, therefore necessitating either a material increase or reduction of the recognized number of genera within the two groups. The differences in the form of the bill presented by *Camarhynchus*, as here defined, from *Geospiza*, while perfectly obvious on comparison of specimens, are extremely difficult to describe, since they result chiefly from variations of curvature in its outlines and relative proportions of various minor details hardly susceptible of exact definition.

The coloration exhibits much more obvious difference than form, none of the species of *Camarhynchus*, so far as known, being entirely black in the adult male; in fact none of them are black posterior to the chest below or the hind neck above, while, with few exceptions, the immature males and females are not distinctly streaked beneath.

KEY TO THE SPECIES OF CAMARHYNCHUS.

a^1. Tomia strongly angulated and basal width of mandible greatly exceeding length of gonys. (*Platyspiza* [1])

b^1. Distinctly streaked with dusky below (Abingdon?, Bindloe?, Albemarle, James, Indefatigable, Chatham, and Charles islands).
1. *C. variegatus* (p. 548).

(?)[2] b^2. Not distinctly streaked below?. (Charles Island?)
2. *C. crassirostris* (p. 551).

a^2. Tomia moderately or very slightly angulated, and basal width of mandible not greatly, if at all, exceeding length of gonys.

b^1. Basal depth of bill equal to or greater than length of maxilla from nostril. (*Camarhynchus.*)

c^1. Basal width of mandible decidedly greater than length of gonys.

d^1. Larger (wing 2.65–3, culmen 0.55–0.61) and rather paler. (James, Jervis, Indefatigable, and Charles islands).. 3. *C. psittaculus* (p. 552).

d^2. Smaller (wing 2.50–2.75, culmen 0.50–0.57) and rather darker. (Albemarle Island)..... 4. *C. affinis* (p. 554).

c^2. Basal width of mandible not decidedly, if at all, greater than length of gonys.

d^1. Culmen 0.60 or more.

e^1. Larger, with stouter bill (wing 2.68 or more, culmen 0.62 or more).

f^1. Rather smaller (wing 2.68–2.75), with smaller and weaker bill (culmen 0.62) and more compressed culmen; wing-coverts in adult male margined with light brown. (Abingdon Island.)
5. *C. habeli* (p. 555).

f^2. Rather larger (wing 2.68–2.92), with larger and stouter bill (culmen 0.64–0.68) and broader culmen; wing-coverts in adult male margined with olive. (Bindloe Island). 6. *C. bindloei* (p. 556).

e^2. Smaller, with weaker bill (wing 2.57, culmen 0.60). (Jervis Island.)
7. *C. compressirostris* (p. 558).

d^2. Culmen less than 0.60.

e^1. Wing 2.70 or more. (Charles Island)..... 8. *C. pauper* (p. 559).

[1] New subgenus: Type, *Camarhynchus variegatus*, Sclater and Salvin.

[2] The interrogation point signifies doubt as to whether this supposed species is correctly placed in this section or subgenus.

e^2. Wing less than 2.70.

f^1. Culmen 0.50 or more.

g^1. Larger, the bill especially (culmen 0.53, basal width of mandible 0.29). (James Island)..... 9. *C. incertus* (p. 560).

g^2. Smaller, especially the bill (culmen 0.50–0.52, basal width of mandible not more than 0.25). (Chatham Island.)
10. *C. salvini* (p. 561).

f^2. Culmen less than 0.50 (about 0.45). (James, Jervis, Indefatigable, Albemarle, and Charles islands) ..11. *C. prosthemelas* (p. 563).

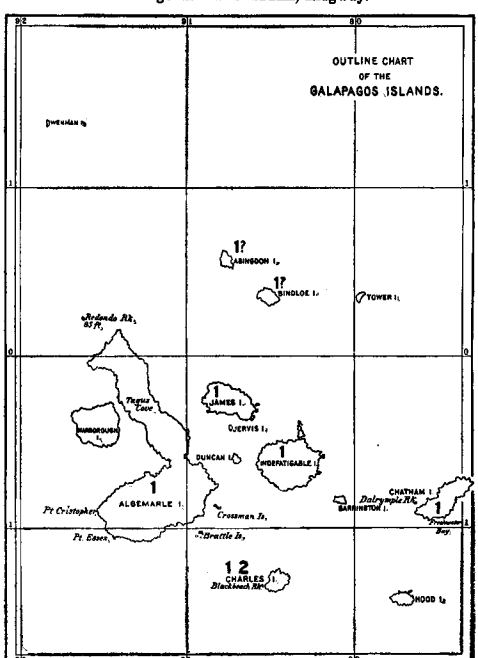
b^2. Basal depth of bill decidedly less than length of maxilla from nostril. (*Cactospiza.*[1])

c^1. Larger and paler (wing 2.72–3, culmen 0.70–0.77, tarsus 0.92–0.94). James, Jervis, and Indefatigable islands).....12. *C. pallidus* (p. 565).

c^2. Smaller and deeper colored (wing 2.65–2.90, culmen 0.67–0.69, tarsus 0.89–0.90). (Albemarle Island).....13. *C. productus* (p. 566).

ASCERTAINED RANGE OF THE GENUS CAMARHYNCHUS, GOULD.

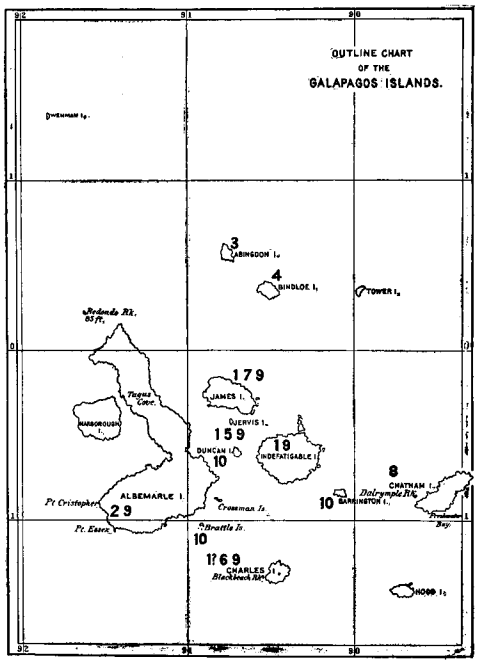
a. Subgenus PLATYSPIZA, Ridgway.



1. *Camarhynchus variegatus*, Sclater and Salvin.
2. *Camarhynchus crassirostris*, Gould.

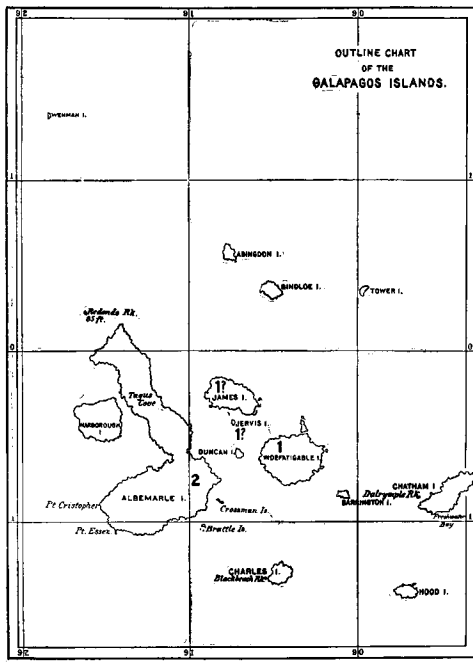
[1] New subgenus. Type, *Cactornis pallida*, Sclater and Salvin.

b. Subgenus CAMARHYNCHUS, Gould.



1. *Camarhynchus psittaculus*, Gould.
2. *Camarhynchus affinis*, Ridgway.
3. *Camarhynchus habeli*, Sclater and Salvin.
4. *Camarhynchus bindloei*, Ridgway.
5. *Camarhynchus compressirostris*, Ridgway.
6. *Camarhynchus pauper*, Ridgway.
7. *Camarhynchus incertus*, Ridgway.
8. *Camarhynchus salvini*, Ridgway.
9. *Camarhynchus prosthemelas*, Sclater and Salvin.
10. (Undetermined form.)

c. Subgenus CACTOSPIZA, Ridgway.



1. *Camarhynchus pallidus* (Sclater and Salvin).
2. *Camarynchus productus*, Ridgway.

CAMARHYNCHUS VARIEGATUS, Sclater and Salvin.

(Plate LVI, fig. 17.)

Camarhynchus variegatus, SCLATER and SALVIN, Proc. Zool. Soc., 1870, pp. 323, 324, fig. 2 ("Abingdon and Bindloes islands," Galapagos Archipelago); Nom. Av. Neotr., 1873, p. 29 —SALVIN, Trans. Zool. Soc. Lond., IX, Pt. IX, 1876, p. 489, pl. LXXXV —SHARPE, Cat. Birds Brit. Mus.,XII, 1888, p. 15.

Camarhynchus crassirostris (nec GOULD?), RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 110 (Charles, Chatham, and Indefatigable islands).

Specific characters.—Culmen strongly convex and maxillary tomium strongly deflected from beneath the nostril to the rictus; gonys straight, strongly ascending terminally, forming a decided angle with the lower edge of the mandibular rami; mandible very broad at the base, where its width greatly exceeds the length of the gonys. Wing, 3.11–3.45; tarsus, 1.05–1.15.

Range.—Galapagos Archipelago: Albemarle Island (Baur and Adams); Charles Island (Townsend, Baur and Adams); Chatham Island (Townsend, Baur and Adams); Indefatigable Island (*Albatross*); James Island (Baur and Adams); ?Abingdon and Bindloe islands (Habel).

Adult male (worn plumage).—No. 125972, U.S.N.M.; Chatham Island, Galapagos, March 30, 1891; C. H. Townsend. Head, neck, and upper chest dull sooty blackish, broken, more or less, by paler edgings to the feathers, deepest and most uniform on upper chest and middle line of throat; upper parts plain brownish olive, lighter and slightly more buffy on the lower rump; the general color of the wings and tail somewhat darker than the back, with the margins of the feathers rather lighter, especially on middle and greater wing-coverts and primaries; under parts, posterior to upper chest, pale creamy yellow, shaded laterally with light olive-brown, the lower chest and sides of breast marked with broad, more or less wedge-shaped, streaks of sooty blackish, these gradually becoming obsolete on the sides; under wing-coverts white tinged with pale creamy yellow, the carpo-metacarpal region with an elongated space of dusky olive-grayish. Bill, legs, and feet wholly black. Length (skin), 5.90; wing, 3.32; tail, 2.10; culmen, 0.70; gonys, 0.30; width of mandible at base, 0.40; depth of bill at base, 0.50; tarsus, 1.10; middle toe, 0.71.

Immature male.—No. 76, collection of Dr. G. Baur; Chatham Island, June 18, 1891. Above olive, the pileum rather broadly and distinctly streaked with dusky, the feathers of the back and scapulars with large central spots of a slightly darker and less olivaceous shade; wings and tail as in the adult male; under parts very pale creamy yellow, the whole chest and sides of breast with broad, mostly wedge-shaped or sagittate spots of deep sooty brown, or sepia, the sides and flanks with narrower and less distinct streaks of the same. Bill, legs, and feet black. Length (skin), 5.50; wing, 3.32; tail, 2.30; culmen, 0.70; gonys, 0.30; width of mandible at base, 0.43; depth of bill at base, 0.53; tarsus, 1.10; middle toe, 0.72.

Young male.—No. 60, collection of Dr. G. Baur; Chatham Island, June 17, 1891. Similar to the immature male, as described above, but margins of wing-coverts more buffy, spots on chest, etc., rather deeper in color, and bill light-colored (basal half of maxilla deep brown, terminal half and whole of mandible pale buffy brownish. Length (skin), 5.80; wing, 3.30; tail, 2.20; culmen, 0.68; gonys, 0.30; width of mandible at base, 0.41; depth of bill at base, 0.52; tarsus, 1.13; middle toe, 0.73.

Young female.—No. 37, same collection and locality, June 16. Similar to the young male as described, but markings on breast, etc., less deep (deep hair brown). Length (skin), 5.55; wing, 3.22; tail, 2.10; culmen, 0.63; gonys, 0.29; width of mandible at base, 0.39; depth of bill at base 0.48; tarsus, 1.05; middle toe, 0.69.

Specimens from the various islands differ appreciably though slightly,

and it is not unlikely that when a series of specimens from each in corresponding plumage can be compared, a greater or less number of local forms may be made out.

I am not entirely sure that the bird here described is the true *C. variegatus*, not having been able to examine specimens from the alleged type locality (Abingdon Island). Regarding the latter question, it may be stated that both Mr. Townsend, naturalist of the U. S. S. *Albatross*, and Messrs. Baur and Adams failed to find any other *Camarhynchus* than *C. habeli* and its near ally, *C. bindloei*, on either Abingdon or Bindloe islands. Dr. Baur writes me as follows:

> Habel, according to Salvin, states that both species [*C. habeli* and *C. variegatus*] are found simultaneously on Bindloe and Abingdon. This is certainly not true.

The question therefore arises: Where were the type and other specimens of *C. variegatus*, accredited to Abingdon and Bindloe islands, respectively, really obtained?

Measurements of Camarhynchus variegatus.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Basal depth of bill.	Gonys.	Basal width of mandible.	Tarsus.	Middle toe.
125972	U. S.	Adult male	Chatham Island	Mar. 30, 1891	3.32	2.10	.70	.30	.40	.50	1.10	.71
38	B. & A.	do	do	June 16, 1891	3.28	2.13	.68	.30	.38	.50	1.12	.71
40	B. & A.	Young male	do	June 14, 1891	3.25	2.10	68	.30	.40	.50	1.10	.70
60	B. & A.	do	do	June 17, 1891	3.30	2.20	.68	.30	.41	.52	1.13	.73
76	B. & A.	Immature male	do	June 18, 1891	3.32	2.30	.70	.30	.43	.53	1.10	.72
89	B. & A.	Young male	do	June 19, 1891	3.30	2.20	.63	.29	.43	.52	1.11	.74
			Average		3.23	2.17	.68	.30	.41	.51	1.11	.72
115911	U. S.	Immature male	Charles Island	Apr. 8, 1888	3.45	2.25	.72	.32	.42	.52	1.12	.75
125967	U. S.	do	do	Apr. 1, 1891	3.45	2.20	.70		.42	.50	1.08	.73
			Average		3.45	2.23	.71	.32	.42	.51	1.10	.74
116040	U. S.	do	Indefatigable Island.	Aug. 12, 1888	3.45	2.25	.70	.30	.41		1.11	.71
116041	U. S.	do	do	do	3.40	2.28	.67	.30	.40	.50	1.12	.70
			Average		3.43	2.27	.69	.30	.41	.50	1.12	.71
37	B. & A.	Young female?	Chatham Island	June 16, 1891	3.22	2.10	.63	.29	.39	.48	1.05	.69
73	B. & A.	do	do	June 18, 1891	3.30	2.20	.65	.30	.39	.50	1.15	.72
			Average		3.26	2.15	.64	.30	.39	.49	1.10	.71
446	B. & A.	Adult female?	Indefatigable Island.	Aug. 6, 1891	3.22	2.07	.68	.29	.35	.49	1.08	.70
513	B. & A.	Adult female	James Island	Aug. 12, 1891	3.11	2.16	.60	.28	.38	.49	1.05	.68
524	B. & A.	do	do	Aug. 13, 1891	3.23	2.13	.62	.28	.38	.50	1.13	.74
			Average		3.17	2.15	.61	.28	.38	.50	1.09	.71
645	B. & A.	Adult? female?	Albemarle Island	July 21, 1891	3.25	2.20	.60	.28	.38	.47	1.08	.68

CAMARHYNCHUS CRASSIROSTRIS, Gould.

(Plate LVI, fig. 18.)

Camarhynchus crassirostris, GOULD, Proc. Zool. Soc., Pt. v, 1837, p. 6 (Galapagos Islands); Zool. Voy. Beagle, III, Birds, 1841, p. 103, pl. XLI (Charles Island?).—BONAPARTE, Consp. Av., I, 1850, p. 542.—GRAY, Gen. B., II, 1844, p. 359; Hand-l., II, 1870, p. 89.—SCLATER and SALVIN, Nom. Av. Neotr., 1873, p. 29.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 489 (Charles Island).—SHARPE, Cat. Birds Brit. Mus., XII, 1888, p. 16 (Charles Island).

Specific characters.—(No specimens seen by me, and the various published descriptions, purporting to have been taken from the same specimen, are conspicuously at variance in regard to the principal characters of plumage, besides showing important discrepancies as to measurements.)

Range.—Galapagos Archipelago: Charles Island? (Darwin.)

Three descriptions of this species, all purporting to have been taken from the same specimen (the type, now in the British Museum), are as follows:

I.

"*C.* (Mas. jun. et Fœm.) corpore superiore intensè brunneo, singulis plumis cinerascenti-olivaceo marginatis; gutture pectoreque cinerascenti-olivaceis, singulis in medio plumis obscurioribus; abdomine lateribus crissoque cinereis stramineo tinctis.

"Long. tot., 5½ unc.; alæ, 3.34; caudæ, 2; tarsi, 1⅛; rostri, ½; alt. rostri, ¼.

"Upper part of the body deep brown, with each feather margined with cinereous olive; the throat and breast cinereous olive, with the middle of each feather darker; the abdomen, sides, and under tail-coverts cinereous tinged with straw-color.

"*Habitat.*—Galapagos Archipelago (Charles Island?)." (Gould.)

II.

"Supra cinereus; capite fuliginoso-nigro: subtus albidus, gula et pectore superiore plumis singulis medialiter nigris: tectricibus alarum et rectricum apicibus fusco albido marginatis: long. tota 5.2, alæ 3, caudæ 1.9, tarsi 0.85, rostri a rictu 0.5.

"*Habitat.*—Charles Island (?) (*Darwin*).

"The type specimen in the British Museum, from which the above description is taken, is probably an adult male." (Salvin.)

III.

"The type specimen is probably a *young male*. It differs from *C. variegatus* in its uniform under surface not being mottled with brown streaks. It has a slight indentation in the cutting edge of the upper mandible answering to *G. dentirostris* in the genus *Geospiza*. Total length, 5.3 inches; culmen, 0.6; wing, 3.05; tail, 1.9; tarsus, 0.9."

(Sharpe.) (It may be remarked that Dr. Sharpe does not think it worth while to question the locality, Charles Island being given without an interrogation mark!)

By comparing the above descriptions with one another it will easily be seen that they differ widely in essential points. In fact, it is difficult to believe that they were not taken from three different birds!

I have a suspicion that this bird may be the same as the form which I have treated in this paper under the title of *C. variegatus*, Sclater and Salvin, which certainly occurs on Charles Island. Should this surmise prove correct, and no error of identification have been made, *C. variegatus* will become a synonym of *C. crassirostris*.

CAMARHYNCHUS PSITTACULUS, Gould.

(Plate LVI, figs. 14–16.)

Camarhynchus psittacula, GOULD, Proc. Zool. Soc., Pt. v, 1837, p. 6 (Galapagos Islands).

Camarhynchus psittaculus, DARWIN, Zool. Voy. Beagle, III, Birds, 1841, p. 103, pl. XL (James Island).—SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Indefatigable Island); Nom. Av. Neotr., 1873, p. 29.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 488 (James and Indefatigable islands).—SHARPE, Cat. Birds Brit. Mus., XII, 1888, p. 16 (James and Indefatigable islands).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1890, p. 109 (James and Indefatigable islands).

? *Camarhynchus townsendi*, RIDGWAY, Proc. U. S. Nat. Mus., XII, No. 767, Feb. 5, 1890, p. 110 (Charles Island, Galapagos Archipelago; collection U. S. Nat. Mus.).

? *Camarhynchus rostratus*, RIDGWAY, Proc. U. S. Nat. Mus., XVII, No. 1007, Nov. 15, 1894, p. 363 (James Island; collection U. S. Nat. Mus.).

Specific characters.—Bill short and stout, its basal depth much exceeding the length of the maxilla from the nostril, and the basal width of the mandible decidedly greater than the length of the gonys. Wing, 2.65–3; culmen (from extreme base), 0.55–0.61; width of mandible at base, 0.43–0.47; depth of bill at base, 0.43–0.47.

Range.—Galapagos Archipelago: ? Charles Island (*Albatross*); Indefatigable Island (Habel, *Albatross*); Jervis Island (Baur and Adams); James Island (Darwin, *Albatross*, Baur and Adams).

Adult male.—No. 116006, U.S.N.M.; James Island, April 11; C. H. Townsend.[1] Head, neck, and chest dull black, passing into dusky sooty brown on forehead; rest of upper parts dull grayish olive, much lighter on rump and upper tail-coverts; lower parts from breast backward dull white, tinged with buff posteriorly, especially on under tail-coverts; breast, particularly on sides, indistinctly but rather broadly streaked with dusky. Bill black, brownish on gonys; tarsi deep horn brown; toes dusky. Length (skin), 5.30; wing, 3; tail, 1.80; culmen, 0.62, very strongly arched; depth of bill at base, 0.48, from base of

[1] Type of *C. rostratus*, Ridgway.

culmen to angle of gonys, 0.50; width of mandible at base, 0.37; tarsus, 1; middle toe, 0.70.

Immature male.—No. 116039, U.S.N.M.; Indefatigable Island, April 12; C. H. Townsend. Above light grayish olive, the top of the head rather grayer, broadly but rather indistinctly streaked with dusky, the feathers of the back still more broadly but much less distinctly darker medially. Supraloral region, malar and suborbital regions, and entire under parts dull grayish white, faintly tinged with yellowish buff, especially on chest and breast; the former and sides of the latter broadly but very indistinctly streaked with grayish dusky. Bill dusky horn color, light brown on edge of maxilla and terminal two-thirds of mandible; tarsi and toes brownish black. Length (skin), 5.30; wing, 2.90; tail, 1.80; culmen, 0.60, very strongly arched; depth of bill at base, 0.45, from base of culmen to angle of gonys, 0.47; tarsus, 0.90; middle toe, 0.62.

Adult female.—No. 564, collection of Dr. G. Baur; James Island, Galapagos, August 17, 1891. Above light grayish olive, the pileum obsoletely streaked with darker and the feathers of the back and scapulars darker centrally, producing an obsolete spotting; rump and upper tail-coverts quite uniform, the latter paler and grayer; wings and tail dusky brownish gray, the feathers with light grayish olive margins, the middle wing-coverts broadly tipped with this color, forming an indistinct band, the greater coverts more narrowly tipped with a paler and somewhat more buffy tint. Lores, orbital region, cheeks, and under parts dull grayish buffy whitish, tinged with dull buff on sides and flanks, where obsoletely streaked with darker; ear-coverts very pale olive-grayish, shading posteriorly into the darker color of the hind neck and below into the dull whitish of the malar region; under wing-coverts white, tinged along edge of the wing with pale yellowish buff. Maxilla cinnamon-brown, becoming dusky at tip and on terminal portion of culmen; mandible buff-yellowish; "iris dark brown;" legs and feet brownish black. Length (skin), 4.70; wing, 2.77; tail, 1.75; culmen, 0.61; gonys, 0.32; width of mandible at base, 0.34; depth of bill at base, 0.45; tarsus, 0.90; middle toe, 0.60.

Fig. 6. Head of *Camarhynchus peittaculus* (Type of *C. townsendi.*)

Immature female.—No. 582; same locality, etc., August 18. Different from the preceding only in the wing-markings, both the middle and greater coverts having much narrower and more sharply defined terminal margins of buffy whitish, the secondaries similarly but less distinctly marked. Length (skin), 4.55; wing, 2.64; tail, 1.60; culmen, 0.55, gonys, 0.30; width of mandible at base, 0.33; depth of bill at base, 0.44; tarsus, 0.90; middle toe, 0.60.

An adult female from Jervis Island in Dr. Baur's collection (No. 464,

August 8, 1891) is essentially identical with that from James Island, the only obvious difference consisting in the slightly paler and grayer color of the pileum and hind neck, with more evident darker streaks, and slight more ochrascent wing-bands. Its measurements are as follows: Length (skin), 4.60; wing, 2.75; tail, 1.75; culmen, 0.57; gonys, 0.30; width of mandible at base, 0.35; depth of bill at base, 0.43; tarsus, 0.90; middle toe, 0.65.

Measurements of Camarhynchus psittaculus.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Basal depth of bill.	Gonys.	Basal width of mandible.	Tarsus.	Middle toe.
115915[1]	U. S.	Immature male	Charles Island	Apr. 8, 1888	2.77	1.65	.59	.30	.34	.43	.90	.60
116006[2]	U. S.	Adult male	James Island	Apr. 11, 1888	3.00	1.82	.61	.30	.37	.47	.95	.65
116039	U. S.	Immature male	Indefatigable Island.	Apr. 12, 1888	2.85	1.85	.60	.30	.36	.45	.90	.62
564	B. & A.	Adult female	James Island	Aug. 17, 1891	2.77	1.75	.61	.32	.34	.45	.90	.60
582	B. & A.	do	do	Aug. 18, 1891	2.64	1.60	.55	.30	.33	.44	.90	.60
			Average		2.71	1.68	.58	.31	.34	.45	.90	.60
464	B. & A.	do	Jervis Island	Aug. 8, 1891	2.75	1.75	.57	.30	.35	.43	.90	.65
115914	U. S.	do	Charles Island	Apr. 8, 1888	2.88	1.73	.58	.30	.35		.95	.65

[1] Type of *Camarhynchus townsendi*, Ridgway.
[2] Type of *Camarhynchus rostratus*, Ridgway.

CAMARHYNCHUS AFFINIS, Ridgway.

Camarhynchus affinis, RIDGWAY, Proc. U. S. Nat. Mus., XVII, No. 1007, Nov. 15, 1894, p. 365 (Albemarle Island, Galapagos Archipelago; collection of Dr. G. Baur.

Specific characters.—Similar to *C. psittaculus*, Gould, but smaller (the bill especially) and with the chest rather broadly and distinctly streaked with dusky. Wing, 2.58–2.75; tail, 1.50–1.70; culmen, 0.50–0.57; basal depth of bill, 0.40; basal width of mandible, 0.30–0.33; tarsus, 0.82–0.90.

Range.—Galapagos Archipelago: Albemarle Island (Baur and Adams).

Adult female?.—Type, No. 598, Dr. Baur's collection, Cowley Bay, on mountains, August 10, 1891. Above light brownish olive, lighter on rump, rather grayer on top of head, where indistinctly streaked with dusky; superciliary stripe (passing to a little behind eye), malar region, and under parts light grayish buff, tinged with brownish on sides (almost isabella color on flanks), and nearly white on abdomen, the chest and sides of breast broadly and rather distinctly streaked with dusky. Bill light brown, paler and yellower on mandible; legs and feet dusky horn color. Length (skin), 4.15; wing, 2.75; tail, 1.70; culmen, 0.57; gonys, 0.30; depth of bill at base, 0.40; width of mandible at base, 0.33; tarsus, 0.90; middle toe, 0.55.

Measurements of Camarhynchus affinis.

Number.	Collection.	Locality.	Date.	Wing.	Tail.	Culmen.	Basal depth of bill.	Gonys.	Basal width of mandible.	Tarsus.	Middle toe.
598	B. & A.	Cowley Bay, East Albemarle Island.	Aug. 10, 1891	2.75	1.70	.57	.30	.30	.40	.90	.55
641	B. & A.	.....do.....	.....do.....	2.58	1.52	.57	.29	.30	....	.80	.55
		Average.....	.....	2.66	1.61	.57	.30	.30	.40	.85	.55

CAMARHYNCHUS HABELI, Sclater and Salvin.

(Plate LVI, fig. 13.)

Camarhynchus habeli, SCLATER and SALVIN, Proc. Zool. Soc., 1870, pp. 323, 325, fig. 3 (part: Abingdon Island, Galapagos Archipelago); Nom. Av. Neotr., 1873, p. 29.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 490, pl. XXXVI (part: Abingdon Island).—SHARPE, Cat. Birds Brit. Mus., XII, 1888, p. 17 (part: Abingdon Island).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 110 (Abingdon Island).

Specific characters.—Bill large, very deep (depth at base equal to or greater than distance from nostril to tip of maxilla), compressed, with culmen strongly arched and gonydeal angle prominent; culmen (in adult male), 0.60 or more; wing, 2.60 or more; adult male with head, neck, and chest grayish black.

Range.—Galapagos Archipelago: Abingdon Island (Habel, *Albatross*).

Adult male.—No. 116130, U.S.N.M.; Abingdon Island, Galapagos, April 16, 1888. Head, neck, and chest dull grayish black, more or less broken by indistinct grayish olive margins to feathers on pileum, pale grayish buffy broad lateral edges to chest feathers, and slight admixture of the same on upper throat; upper parts olive, the feathers of the back with indistinctly darker centers; wings and tail dusky, with olive edgings, those of the middle and greater wing-coverts broader and wood brown in hue; under parts, posterior to chest, plain pale buffy or dull cream color, shaded with pale olive on sides and flanks; bill entirely black; legs and feet brownish black. Length (skin), 5.15; wing, 2.75; tail, 1.73; culmen, 0.62; gonys, 0.31; basal width of mandible, 0.32; basal height of bill, 0.42; tarsus, 0.90; middle toe, 0.61.

Adult female.—Gray above, whitish beneath, the head, etc., without any black.[1] "Similar to *C. psittaculus*, but smaller. Total length, 4.4 inches; culmen, 0.6; wing, 2.7; tail, 1.5; tarsus, 0.85." (Sharpe.)

Of this form I have seen only two specimens, both adult males, one of which is described above. The other (No. 116131, same data) does not differ in coloration, but is somewhat smaller, its measurements being as follows: Length (skin), 4.65; wing, 2.68; tail, 1.63; culmen,

[1] Salvin, Proc. Zool. Soc., 1870, pp. 323, 325 (translation).

0.62; gonys, 0.32; basal width of mandible, 0.31; basal depth of bill, 0.42; tarsus, 0.89; middle toe, 0.58.

CAMARHYNCHUS BINDLOEI, Ridgway.

Camarhynchus habeli (part), SCLATER and SALVIN, Proc. Zool. Soc., 1870, pp. 323, 325 (Bindloe Island).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 490 (Bindloe Island).—SHARPE, Cat. Birds Brit. Mus., XII, 1888, p. 17 (Bindloe Island).

Camarhynchus bindloei, RIDGWAY, Proc. U. S. Nat. Mus. XVIII, No. 1067, April 23, 1896, p. 294 (Bindloe Island, Galapagos Archipelago; collection of Dr. G. Baur).

Specific characters.—Similar to *C. habeli*, Sclater and Salvin, of Abingdon Island, but rather larger, with decidedly larger bill, the latter with culmen much less compressed.

Range.—Galapagos Archipelago: Bindloe Island (Habel; Baur and Adams).

Adult male.—Type, in collection of Dr. G. Baur; Bindloe Island, Galapagos, September 5, 1891. Head, neck, and upper chest uniform dull black, the feathers of the occiput and hind neck with obsolete margins of grayish olive, and those of the throat and chest indistinctly fringed with a paler tint of the same; rest of upper parts plain olive, becoming lighter and tinged with buffy on the rump; wings and tail grayish dusky, the feathers margined with grayish olive (lighter and more buffy on primaries), the wing coverts with broad margins of deep olive-grayish, instead of buffy brown or wood brown, as in *C. habeli:* lower chest with feathers blackish centrally broadly margined with pale buff-yellowish, producing a spotted or somewhat squamate appearance; rest of under parts pale buff-yellowish, washed with buffy olive on sides and flanks, the crissum more buffy; under wing-coverts mainly white, deepening into light olive-grayish along edge of wing, this becoming darker and forming a rather distinct patch on the carpo-metacarpal region. Maxilla deep brown, obsoletely streaked with blackish, the terminal portion also chiefly blackish; mandible clouded with lighter brown and dusky, the latter chiefly on lower basal portion; legs and feet blackish brown. Length (skin), 4.50; wing, 2.92; tail, 1.82; culmen, 0.68; gonys, 0.31; width of mandible at base, 0.33; depth of bill at base, 0.45; tarsus, 0.85; middle toe, 0.60.

Immature male.—Same collection, locality, etc. Similar to the adult female of *C. psittaculus*, but bill longer and relatively narrower. Above light olive, the feathers of the pileum with rather distinct darker mesial streaks and those of the back with broader and much less distinct streaks, the general color becoming lighter and more buffy on the rump; wings and tail dusky olive-grayish, the feathers margined with paler, these margins broader and more buffy on wing-coverts, those on the middle coverts chiefly terminal, producing a rather broad and distinct band. Face and under parts pale buff yellowish, faintly shaded

with pale olive-brownish on sides and flanks. Maxilla light tawny, darker and more brownish terminally, especially on culmen; mandible lighter, approaching ochraceous-yellow; legs and feet grayish black. Length (skin), 4.60; wing, 2.68; tail, 1.78; culmen, 0.67; gonys, 0.32; width of mandible at base, 0.33; depth of bill at base, 0.42; tarsus, 0.88; middle toe, 0.63.

Adult female?.—Same collection, etc. Similar to the supposed immature male, but rather darker and much grayer above, with dark streaks on pileum broader and lighter, margins of wing-coverts light brownish gray on middle row and faintly buffy grayish on greater series; under parts much less yellowish, the color being buffy white, tinged with pale brownish laterally, where very obsoletely streaked (rather broadly) with pale brownish gray; bill not quite so bright in color. Length (skin), 4.45; wing, 2.65; tail, 1.65; culmen, 0.64; gonys, 0.33; width of mandible at base, 0.34; depth of bill at base, 0.44; tarsus, 0.90; middle toe, 0.62.

Another supposed adult female in Dr. Baur's collection is similar in color to the one described except that the whitish of the face and under parts is slightly more yellowish. It is also slightly larger, its measurements being as follows: Wing, 2.73; tail, 1.70; culmen, 0.68; gonys, 0.32; width of mandible at base, 0.34; depth of bill at base, 0.44; tarsus, 0.87; middle toe, 0.61.

The specimens above described were skinned from alcohol, and it was found impossible to determine their sex, having been eviscerated before their preservation. It is therefore possible that the supposed immature male is in reality an immature female. It certainly is not a very young bird. That the other two are adult females I think there can be no reasonable doubt.

This bird is so closely related to *C. habeli* of Abingdon Island, that I have hesitated long before separating it; but the decidedly broader culmen and somewhat different shape of the bill and the slight, though apparently constant, color-characters mentioned seem to warrant its recognition as a local form.

Comparative measurements of Camarhynchus habeli and C. bindloei.

CAMARHYNCHUS HABELI.

Number.	Collection.	Sex and age	Locality.	Date.	Wing.	Tail.	Culmen.	Basal depth of bill.	Gonys.	Basal width of mandible.	Tarsus.	Middle toe.
116130	U. S.	Adult male	Abingdon Island.	Apr. 16, 1888	2.75	1.73	.62	.42	.31	.32	.90	.61
116131	U. S.	.....do.....	.....do.....	.....do.....	2.68	1.63	.62	.42	.32	.31	.89	.58
			Average		2.74	1.68	.62	.42	.31+	.31+	.89+	.60+

Comparative measurements of Camarhynchus habeli and C. bindloei—Continued.

CAMARHYNCHUS BINDLOEI.

.....	B.& A.	Adult male....	Bindloe Island.	Sept. 5, 1891	2.92	1.82	.68	.45	.31	.33	.85	.60
.....	B.& A.	Immature male	.....do	.....do	2.68	1.78	.67	.42	.32	.33	.88	.63
			Average		2.80	1.75	.67+	.44+	.31+	.33	.87+	.62+
.....	B.& A.	Adult female?.	Bindloe Island.	Sept. 5, 1891	2.73	1.70	.68	.44	.32	.34	.87	.61
.....	B.& A.	Adult female..	.....do	.....do	2.65	1.65	.64	.44	.33	.34	.90	.62
			Average		2.68	1.68+	.66	.44	.32+	.34	.88+	.61+

CAMARHYNCHUS COMPRESSIROSTRIS, Ridgway.

(Plate LVI, fig. 12.)

Camarhynchus compressirostris, RIDGWAY, Proc. U. S. Nat. Mus., XVIII, No. 1067, April 23, 1896, p. 294 (Jervis Island, Galapagos Archipelago; collection of Dr. G. Baur).

Specific characters.—(Adult male unknown.) Adult female similar to that of *C. psittaculus*, Gould, but smaller, with the bill much narrower, more compressed, and with straighter culmen; basal width of mandible less than length of gonys instead of greater, and basal depth of bill less than length of maxilla from nostril. Wing less than 2.60; culmen (from extreme base), 0.60; basal depth of bill, 0.40.

Range.—Galapagos Archipelago: Jervis Island (Baur and Adams).

Adult female.—Type, No. 471, collection of Dr. G. Baur; Jervis Island, Galapagos, August 8, 1891. Above light olive (less grayish than in *C. psittaculus*, more so than in *C. incertus*) the pileum obsoletely streaked and the back spotted with darker; wings and tail dusky grayish brown, the feathers with light buffy olive margins, the middle and greater wing-coverts broadly tipped (the former sharply) with pale brownish buff; face and under parts very pale yellowish buff, tinged with pale olive-brown on sides and flanks, where obsoletely streaked (broadly) with grayish olive-brown; under wing-coverts white tinged with pale buff, most strongly toward edge of wing. Maxilla pale cinnamon-brown, with terminal portion of culmen dusky; mandible paler, inclining to brownish buff; "iris very dark brown;" legs and feet blackish brown. Length (skin), 4.25; wing, 2.57; tail[1]; culmen, 0.60; gonys, 0.32; width of mandible at base, 0.29; depth of bill at base, 0.40; tarsus, 0.90; middle toe, 0.60.

While very closely resembling the female of *C. psittaculus* in general appearance, the decidedly shorter wing and very different proportions of the bill will serve to readily distinguish it from that form.

[1] Rectrices only partly grown out.

CAMARHYNCHUS PAUPER, Ridgway.

(Plate LVI, fig. 11.)

Camarhynchus pauper, RIDGWAY, Proc. U. S. Nat. Mus., XII, No. 767, Feb. 5, 1890. p. 111 (Charles Island, Galapagos Archipelago; collection U. S. Nat. Mus.).

Specific characters.—Similar in form and coloration to *C. prosthemelas*, Sclater and Salvin, but very much larger. Wing, 2.70–2.85; tail, 1.65–1.70; culmen, 0.50–0.58; basal depth of bill, 0.35; tarsus, 0.85–0.96.

Range.—Galapagos Archipelago: Charles Island (*Albatross*).

Adult male.—No. 125968, U.S.N.M.; Charles Island, Galapagos, April 1, 1891; C. H. Townsend. Top of head and hind neck dull blackish brown, indistinctly streaked with grayish olive; sides of head nearly plain grayish olive, more dusky on cheeks; throat and chest dull black, broken by occasional streaks of pale olive-buff, this color predominating on chin; rest of under parts very pale olive-buff, inclining to white, the whole breast broadly streaked with blackish, these streaks continued backward over sides to flanks, both the latter being light buffy olive laterally; under tail-coverts decided pale buff. Upper parts olive, lighter on rump, the feathers of the dorsal tract much darker centrally, forming very broad but rather indistinct dusky streaks. Bill entirely deep black; legs and feet brownish black. Length (skin), 4.50; wing, 2.75; tail, 1.68; culmen, 0.55; gonys, 0.30; bill from nostril, 0.38; tarsus, 0.90; middle toe, 0.57.

An adult male in more abraded plumage (No. 125969, U.S.N.M.; Charles Island, April 1, 1891; C. H. Townsend) differs from that described above as follows:

Head, all round, nearly uniform brownish black, passing into dusky grayish brown on hind neck, and this into plain dusky olive on dorsal region; black of throat and chest much more abruptly defined against the buffy whitish of the breast, the latter with far fewer and less distinct streaks, the sides and flanks not streaked at all. Otherwise, the coloration is the same. Length (skin), 5; wing, 2.85; tail, 1.70 (much worn); culmen, 0.58; gonys, 0.30; bill from nostril, 0.38; tarsus, 0.96; middle toe, 0.60.

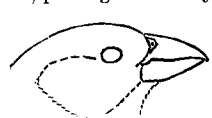


Fig. 7. Head of *Camarhynchus pauper*. (Type.)

Adult female.—Type, No. 115913, U.S.N.M.; Charles Island, Galapagos, April 8, 1888; U. S. S. *Albatross*. Above olive, the feathers of the head and back slightly darker centrally, the olive color paler on the the rump; wings and tail dull grayish dusky with lighter olive-grayish edgings, these dull buffy on middle and greater wing-coverts; supraloral space and malar region pale dull grayish buffy; chin and throat similar but paler and more grayish; rest of under parts pale buffy fading into nearly white on belly; sides and flanks tinged with grayish olive, and chest very faintly flammulated with the same. Bill wholly grayish

black; legs and feet dusky brown. Length (skin), 4.60; wing, 2.70, tail, 1.65; culmen, 0.50; gonys, 0.30; bill from rictus, 0.50; depth at base, 0.35; tarsus, 0.85; middle toe, 0.58.

The relationships of this species are evidently with *C. prosthemelas* rather than *C. psittaculus* and allied forms, the bill being even more compressed and elongated. In coloration, the adult males resemble them about equally, there being no material difference between the various species of the group.[1]

The adult female most resembles that of *C. prosthemelas*, but has the chest and sides darker (distinctly brownish buffy), the former without distinct streaks, at least in the single specimen examined.

An immature bird of undetermined sex (No. 52401, U.S.N.M.; Charles Island; received from Professor Sundevall) is darker and browner above than the adult female described above, has the under parts paler with distinct dusky streaks on the chest, and has the bill light colored (maxilla light brown, mandible pale dull buffy).

Measurements of Camarhynchus pauper.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Basal depth of bill.	Gonys.	Basal width of mandible.	Tarsus.	Middle toe.
125968	U. S.	Adult male	Charles Island.	Apr. 1, 1891	2.80	1.70	.58	.30	.30	.37	.91	.60
125969	U. S.	do	do	do	2.85	1.73	.58	.30	.29	....	.91	.63
			Average.		2.83+	1.72+	.58	.30	.29+	.37	.91	.62+
115913	U. S.	Adult female	Charles Island.	Apr. 8, 1888	2.69	1.58	.57	.29	.28	.35	.85	.60

CAMARHYNCHUS INCERTUS, Ridgway.

Camarhynchus incertus, RIDGWAY, Proc. U. S. Nat. Mus., XVIII, No. 1067, April 23, 1896, p. 294 (James Island, Galapagos Archipelago; collection of Dr. G. Baur).

Specific characters.—Adult male unknown. Adult female most like that of *C. compressirostris*, Ridgway, of Jervis Island, but smaller (the bill especially), with upper parts brighter olivaceous and under parts distinctly yellowish buff. Similar in color to *C. salvini*, Ridgway, of Chatham Island, but much larger. Wing, 2.50; tail, 1.50; culmen, 0.53; tarsus, 0.82.

Range.—Galapagos Archipelago (James Island, Baur and Adams).

Adult female.—Type, No. 521, collection of Dr. G. Baur; James Island, Galapagos, August 13, 1891. Above bright buffy olive, the pileum rather distinctly streaked with grayish dusky, the back and scapulars more obsoletely and broadly streaked or spotted with the same, entirely

[1] Excepting possibly *C. salvini*, of which I have never seen a black-headed male.

uniform posterior to the back, the color lighter and more distinctly buffy on the lower rump; wings and tail dusky grayish brown, the feathers with distinct lighter margins (very narrow, and pale olive-gray on the primaries), the middle and greater coverts tipped with dull buff, forming two fairly distinct bands.[1] A superciliary stripe (disappearing above the ear coverts), and general color of under parts pale yellowish buff, shaded with brownish along the sides and flanks, where obsoletely streaked (most distinctly on flanks) with dusky olivaceous; under wing-coverts white, tinged, especially along edge of wing, with pale cream-yellow. Maxilla light cinnamon with dusky tip; mandible very pale brownish buffy; "iris dark brown;" legs and feet blackish brown. Length (skin), 4.30; wing, 2.50; tail, 1.50; culmen, 0.53; gonys, 0.29; width of mandible at base, 0.29; tarsus, 0.82; middle toe, 0.57.

The bird described above is absolutely similar in plumage to *C. salvini*, of Chatham Island, but is nearly as large as *C. compressirostris*. Were these two species found together on the same island, I would be disposed to consider the present bird a hybrid; but manifestly this can not be the case. It is possible that a larger series of specimens would run *C. compressirostris* and *C. incertus* together, in which case there would be another form common to the two islands of James and Jervis; but for the present I have to consider them as different.

CAMARHYNCHUS SALVINI, Ridgway.

(Plate LVI, fig. 9.)

Camarhynchus prosthemelas (nec SCLATER and SALVIN), SUNDEVALL, Proc. Zool. Soc., 1871, p. 125, part (Chatham Island).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 110, part (Chatham Island).

Camarhynchus salvini, RIDGWAY, Proc. U. S. Nat. Mus., XVII, No. 1007, Nov. 15, 1894, p. 364 (Chatham Island, Galapagos Archipelago; collection U. S. Nat. Mus.).

Specific characters.—Similar to *C. prosthemelas*, Sclater and Salvin, of James, Indefatigable and Charles islands, etc., but larger, more strongly tinged with buffy yellow and more extensively streaked beneath, the adult male apparently without any black on head, neck or chest. Wing, 2.45–2.63; tail, 1.45–1.58; culmen, 0.48–0.52; tarsus, 0.81–0.88.

Range.—Galapagos Archipelago: Chatham Island (Kinberg, Townsend, Baur and Adams).

Adult (?) male (worn plumage).—Type, No. 125977, U.S.N.M.; Chatham Island, Galapagos, March 30, 1891; C. H. Townsend. Above, including pileum, dusky olive, the feathers with lighter olive edges, producing an indistinctly streaked appearance; rectrices edged with more yellowish olive; under parts dull buffy whitish, the chest, sides, and flanks streaked with dusky (most distinct on chest, least so on flanks, where

[1] The molt is nearly complete, but a few of the outermost greater wing-coverts belong to the unmolted plumage. These old feathers, perhaps representing an immature dress, corresponding to that described under *C. psittaculus*, are margined both laterally and terminally with dull whitish, only very faintly tinged with buff.

the color of the streaks is nearly that of the back). Bill wholly deep black; legs and feet brownish black. Length (skin), 4.25; wing, 2.60; tail, 1.55; culmen, 0.52; gonys, 0.27; depth of bill at base, 0.25; tarsus, 0.88; middle toe, 0.57.

Adult (?) *female* (*fresh plumage*).—No. 125978, U.S.N.M.; same locality, etc. Above dark olive, the feathers margined with lighter, more buffy olive, the latter nearly uniform on rump and upper tail-coverts; under parts palé straw yellow, the chest, sides, and flanks broadly striped with dusky olive. Bill light brown, the mandible rather paler, especially underneath; legs and feet blackish brown. Length (skin), 4.05; wing, 2.48; tail, 1.45; culmen, 0.50; gonys, 0.25; depth of bill at base, 0.23; tarsus, 0.85; middle toe, 0.53.

Young male.—No. 98, collection of Dr. G. Baur, Chatham Island, June 22, 1891. Similar to the adult (?) female, as described above, but upper parts rather more distinctly streaked with darker, especially on pileum, and under parts brighter buff-yellow, with dusky streaks narrower, very distinct only on chest; superciliary region conspicuously light yellowish buff; bill light buffy cinnamon, the mandible paler. Length (skin), 4.20; wing, 2.63; tail, 1.58; culmen, 0.50; gonys, 0.25; basal width of mandible, 0.28; basal depth of bill, about 0.32;[1] tarsus, 0.81; middle toe, 0.55.

Young female.—No. 53, collection of Dr. G. Baur, Chatham Island, June 16, 1891. Similar to the young male, as described above, but upper parts more buffy olive, with darker streaks on pileum, etc., less distinct, and under parts without distinct streaks, even on chest. Length (skin), 3.90; wing, 2.45; tail, 1.50; culmen, 0.48; gonys, 0.25; basal width of mandible, 0.26; basal depth of bill, 0.32; tarsus, 0.82; middle toe, 0.54.

It may be that the fully adult male of this species has the head and chest blackish, as in *C. prosthemelas*, *C. pauper*, and other forms.

In addition to the eleven specimens in the National Museum collection, procured by Mr. C. H. Townsend, naturalist of the United States Fish Commission Steamer *Albatross*, Dr. Baur's collection contains seven examples from the same island.

Measurements of Camarhynchus salvini.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Basal depth of bill.	Gonys.	Basal width of mandible.	Tarsus.	Middle toe.
125973	U. S.	Adult male?	Chatham Island	Mar. 30, 1891	2.52	1.55	.50	.35	.25	.28	.89	.56
125974	U. S.	Adult male	do	do	2.56	1.58	.55	.35	.28	.27	.88	.58
125975	U. S.	do	do	do	2.49	1.52	.50	.....	.25	.28	.85	.53
125976	U. S.	do	do	do	2.50	1.50	.50	.34	.25	.28	.85	.50
125977	U. S.	do	do	do	2.58	1.55	.52	.35	.27	.27	.88	.54
			Average		2.53	1.54	.51	.35	.26	.28	.87	.54
125978	U. S.	Adult female.	Chatham Island	Mar. 30, 1891	2.49	1.48	.50	.35	.25	.28	.87	.55

CAMARHYNCHUS PROSTHEMELAS, Sclater and Salvin.

(Plate LVI, fig. 10.)

Camarhynchus prosthemelas, SCLATER and SALVIN, Proc. Zool. Soc., 1870, pp. 323, 325, fig. 4 (Indefatigable Island, Galapagos Archipelago); Nom. Av. Neotr., 1873, p. 29.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 490.—SHARPE, Cat. Birds Brit. Mus., XII, 1888, p. 17 (Indefatigable and James islands).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 110 (part: Charles and James islands).

Specific characters.—Smallest species of the genus (wing not exceeding 2.55).

Range.—Galapagos Archipelago: Albemarle Island (Baur and Adams); Charles Island (Kinberg, Townsend, Baur and Adams); Indefatigable Island (Habel, Baur and Adams); Jervis Island (Baur and Adams); James Island (*Albatross*, Baur and Adams).

Adult male.—No. 115909, U.S.N.M.; Charles Island, Galapagos, April 8, 1888; C. H. Townsend. Head, neck, and chest uniform black, ending abruptly beneath in a convex outline; rest of under parts plain buffy white, tinged with olive-gray laterally; rest of upper parts olive, the feathers of the back with indistinct darker centers; remiges and rectrices dusky, margined with grayish olive, the edges of the outermost primaries approaching grayish white. Bill, legs, and feet entirely black. Length (skin), 3.85; wing, 2.50; tail, 1.50; culmen, 0.45; gonys, 0.22; depth of bill at base, 0.30; tarsus, 0.93; middle toe, 0.55.

Adult male (in worn plumage).—No. 125970, U.S.N.M.; same locality and collector, April 1, 1891. Essentially similar to the specimen described above, but black of anterior lower parts not extending farther backward than fore neck, the chest being whitish, broadly streaked with dusky; upper parts, posterior to pileum, plain dusky olive-grayish. Length (skin), 4; wing, 2.55; tail, 1.57; culmen, 0.45; gonys, 0.22; tarsus, 0.79; middle toe, 0.51.

Immature male.—No. 116010, U.S.N.M.: James Island, April 11, 1888; C. H. Townsend. Pileum and hind neck dusky, the feathers very indistinctly edged with grayish olive; rest of upper parts dull grayish olive, the feathers of back dusky centrally; under parts (including throat, etc.) dull grayish white, tinged with pale yellowish buff, passing into pale olive-brownish on sides and flanks, the chest and sides of breast streaked with dusky. Otherwise as in adult male. Length (skin), 4.15; wing, 2.52; tail, 1.60; culmen, 0.45; gonys, 0.21; depth of bill at base, 0.30; tarsus, 0.78; middle toe, 0.58.

Young male.—No. 421, collection of Dr. G. Baur; Indefatigable Island, August 5, 1891. Above rather light olive-gray, becoming paler and tinged with buffy on rump, the pileum and hind neck broadly and distinctly streaked with dusky, and feathers of the back and scapulars with a large, sharply defined central spot of the same; wings and tail dusky, the feathers margined with light olive-grayish, paler and

more buffy on middle and greater wing-coverts; under parts white, very faintly tinged with pale buffy, shaded on sides and flanks with pale brownish buffy, and sparsely streaked across chest and along sides with dusky olive-grayish. Bill pale cinnamon-brown, the mandible lighter and more buffy. Length (skin), 3.70; wing, 2.42; tail, 1.57; culmen, 0.45; gonys, 0.20; basal width of mandible, 0.25; basal depth of bill, 0.31; tarsus, 0.79; middle toe, 0.52.

Adult female.—No. 460, collection of Dr. G. Baur; Indefatigable Island, August 7, 1891. Similar to the young male described, but dusky streaks of pileum and hind neck and spots on dorsal region very much less distinct, the upper surface in general being nearly plain light buffy olive-grayish. Length (skin), 3.70; wing, 2.40; tail, 1.45; culmen, 0.46; gonys, 0.22; basal width of mandible, 0.27; basal depth of bill, 0.31; tarsus, 0.80; middle toe, 0.56.

Young female.—No. 457, collection of Dr. G. Baur; Indefatigable Island, August 7, 1891. Similar to the adult female, but more olivaceous and still more uniform above, and under parts strongly tinged with light brownish buffy, especially on chest, sides, and flanks, which are not obviously streaked. Length (skin), 3.70; wing, 2.37; tail, 1.43; culmen, 0.46; gonys, 0.24; basal width of mandible, 0.25; basal depth of bill, 0.32; tarsus, 0.80; middle toe, 0.50.

Although specimens have been examined from all the islands known to be inhabited by this species, adult males from only two of them, James and Charles, have been seen by me.[1] These do not differ so far as I can discover, and I am unable to detect any constant differences between the females and immature birds from the several islands.

Measurements of Camarhynchus prosthemelas.

Number.	Collection.	Sex and age	Locality.	Date.	Wing.	Tail.	Culmen.	Basal depth of bill.	Gonys.	Basal width of mandible.	Tarsus.	Middle toe.
115909	U. S.	Adult male	Charles Island	Apr. 8, 1888	2.51	1.60	.46	.32	.23	.27	.82	.55
125970	U. S.	....do	....do	Apr. 1, 1891	2.55	1.60	.45	.32	.22	.24	.77	.53
125971	U. S.	Immature male.	....do	....do	(2.30)	(1.43)	.44	.32	.23	.26	.78	.53
				Average.	2.53	1.60	.45	.32	.23	.26	.79	.54+
116007	U. S.	Adult male	James Island.	Apr. 11, 1888	2.37	1.52	.41	.31	.21	.25	.79	.50
116008	U. S.	....do	....do	....do	2.49	1.45	.41	.31	.22	.27	.79	.52
116009	U. S.	....do	....do	....do	2.50	1.55	.43	.32	.21	.25	.81	.50
116010	U. S.	Immature male.	....do	....do	2.51	1.58	.45	.32	.22	.27	.80	.53
				Average.	2.47	1.53+	.43+	.32	.22+	.26	.80	.51

[1] Specimens examined are as follows: Albemarle Island, 3 specimens (no adult males); James Island, 8 specimens (3 adult males); Jervis Island, 3 specimens (no adult males); Indefatigable Island, 7 specimens (no adult males); Charles Island, 4 specimens (2 adult males).

CAMARHYNCHUS PALLIDUS (Sclater and Salvin).

(Plate LVI, fig. 7.)

Cactornis pallida, SCLATER and SALVIN, Proc. Zool. Soc., 1870, pp. 323, 327 (Indefatigable Island, Galapagos Archipelago); Nom. Av. Neotr., 1873, p. 29.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 487.—SHARPE, Cat. Birds Brit. Mus., XII, 1888, p. 20 (Indefatigable Island).

? *Cactornis pallida*, SCLATER and SALVIN?, RIDGWAY, Proc. U. S. Nat. Mus., XII, 1890, p. 109 (James Island).

? *C[actornis] hypoleuca*, RIDGWAY, Proc. U. S. Nat. Mus., XII, No. 767, Feb. 5, 1890, p. 109, in text (James Island, Galapagos Archipelago; collection U. S. Nat. Mus.).

Specific characters.—(Adult male unknown.) Adult female and immature male and female closely similar in coloration and general dimensions to corresponding plumages of *C. psittaculus*, Gould, but bill very different in form, being slender and compressed, with its basal depth much less than the distance from the nostril to the tip of the maxilla, and the basal width of the mandible also much less than the length of the gonys. Culmen (from extreme base), 0.70–0.77; tarsus, 0.92–0.94.

Range.—Galapagos Archipelago: Indefatigable Island (Habel); Jervis Island (Baur and Adams); James Island (*Albatross*, Baur and Adams).

Immature male.—No. 115997, U.S.N.M; James Island, Galapagos, April 11, 1888; C. H. Townsend; type of *Cactornis hypoleuca*, Ridgway. Above plain light grayish olive, the pileum very indistinctly streaked with darker; wings dusky, with pale grayish olive edgings, the middle and greater coverts edged more broadly with dull buffy. A superciliary stripe (becoming obsolete above auriculars), suborbital and malar regions, and entire lower parts dull white tinged with pale buffy on under parts of the body, the under tail-coverts more decidedly so; sides of chest very indistinctly streaked with pale grayish. Bill pale yellowish brown (the mandible lighter and more yellowish), darker at tip; legs and feet blackish brown. Length (skin), 5.70; wing, 2.95; tail, 1.80; culmen, 0.77; gonys, 0.39; bill to rictus, 0.70; width of mandible at base, 0.31; depth of bill at base, 0.39; tarsus, 0.90; middle toe, 0.68.

Adult (?) female.—No. 552, collection of Dr. G. Baur; James Island, Galapagos, August 16, 1891. Similar to the immature male, as described above, but with very distinct and rather broad streaks of grayish olive on chest, sides, and flanks. Length (skin), 4.45; wing, 2.72; tail, 1.64; culmen, 0.70; gonys, 0.38; width of mandible at base, 0.30; depth of bill at base, 0.39?;[1] tarsus, 0.92; middle toe, 0.66.

An immature male from Jervis Island in Dr. Baur's collection (No. 469, August 8, 1891) is very similar to the James Island specimen described above, but is appreciably more olivaceous above, has the under parts distinctly tinged with pale buffy yellowish, and is slightly smaller, its measurements being as follows: Length (skin), about 4.80; wing,

[1] The bill is not tightly closed, and this measurement therefore only approximately correct.

2.82; tail, 1.85; culmen, 0.75 gonys, 0.39; width of mandible at base, 0.30; depth of bill at base, 0.38; tarsus, 0.93; middle toe, 0.65.

I am still somewhat doubtful whether the birds described above are really the *Cactornis pallida* of Sclater and Salvin, not having been able to compare them with a specimen from Indefatigable Island. The original description, the brevity of which renders it unsatisfactory, certainly does not agree well with any of the specimens examined, particularly in regard to the coloration of the under parts, which are described as being pale ochraceous, the under surface of the two James Island and single Jervis Island specimens being essentially white, very slightly tinged with buff-yellowish. Dr. Sharpe, however, in describing the same specimen, says that the under parts are "white, slightly washed with olive-yellow," which agrees very well with the specimens before me. There are also some slight discrepancies in measurements, which, however, may be the result of somewhat different methods of measuring.[1]

CAMARHYNCHUS PRODUCTUS, Ridgway.

(Plate LVI, fig. 8.)

Camarhynchus productus, RIDGWAY, Proc. U. S. Nat. Mus., XVII, No. 1007, Nov. 15, 1894, p. 364 (Albemarle Island, Galapagos Archipelago; collection of Dr. G. Baur).

Specific characters.—Similar to *C. pallidus*, Sclater and Salvin, but smaller (the bill especially) and deeper colored. Culmen (from extreme base), 0.67–0.69; tarsus, 0.89–0.90.

Range.—Galapagos Archipelago: Albemarle Island (Baur and Adams).

[1] The descriptions referred to are as follows:

(*a*) Original description:

"Supra olivaceo-fusca, alis caudaque obscure fuscis, dorso colore anguste limbatis; subtus pallide ochracea; tectricibus subalaribus et remigum marginibus internis albis; rostro pallide corneo, pedibus nigris; long. tota 4.7, alæ 2.7, c auda 1.7, rostr a rictu 0.65, tarsi 0.9.

"Fem. *mari similis.*

"*Hab.*—Indefatigable Island.

"*Obs.*—Colore ab omnibus distincta, sed forsan avis haud adulta. Altamen mas et femina, specimina sola quæ nobis adsunt, vestitu omnino congruunt."

(*b*) Sharpe's description:

"*Male* (? *in seasonal plumage*).—General color above pale olive-brown, with ashy margins to the feathers; lesser wing-coverts like the back; median and greater wing-coverts brown, edged with whity brown, more broadly on the former series; primary-coverts and quills dark brown, edged with ashy olive or paler olive-brown on the secondaries; tail-feathers brown, margined with olive-brown; head a little duller than the back; lores, eyelid, and feathers below the eye whitish, tinged with olive-yellow; ear-coverts light olive-brown, with whitish shaft-lines; cheeks, throat, and under surface of body white, slightly washed with olive-yellow, with a few dusky streaks on the chest; flanks and sides of body pale fulvous-brown; under wing-coverts white, tinged with olive-yellow. Total length, 4.8 inches; culmen, 0.7; wing, 2.7; tail, 1.7; tarsus, 0.85.

"*Adult female.*—Similar to the male. Total length, 5 inches; culmen, 0.65; wing, 2.85; tail, 1.7; tarsus, 0.9."

Immature male.—Type, No. 404, collection of Dr. G. Baur; Albemarle Island, July 31, 1891. Above bright olive, without obviously darker centers to the feathers of the back, etc.; wings and tail grayish dusky, the feathers broadly margined with buffy olive, the primaries narrowly edged with light yellowish olive; lores dull whitish, the feathers with grayish bases; superciliary region (passing but little behind eyes) yellowish buffy, the cheeks similar but slightly paler; general color of under parts pale buff-yellowish, faintly tinged with olive across chest, and strongly washed with buffy brown on sides and flanks, where obsoletely but broadly streaked with a darker and more grayish shade. Maxilla brownish black, becoming horn brown along tomium; mandible horn brown, darker at tip; legs and feet blackish horn color; "iris dark brown." Length (skin), 4.80; wing, 2.90; tail, 1.80; culmen, 0.68; gonys, 0.32; width of mandible at base, 0.27; depth of bill at base, 0.33; tarsus, 0.90; middle toe, 0.61.

Immature (?) female.—No. 367, collection of Dr. G. Baur; Albemarle Island, July 23, 1891. Essentially similar to the male, as described above, but upper parts more buffy olive, under parts wholly clear light buff-yellowish (the flanks only very obsoletely streaked with darker), and bill much lighter colored, the maxilla pale cinnamon and the mandible buffy whitish, both tipped with dusky brown; legs and feet dark brown. Length (skin), 4.50; wing, 2.70; tail, 1.70; culmen, 0.67; gonys, 0.33; width of mandible at base, 0.28; depth of bill at base, 0.34; tarsus, 0.89; middle toe, 0.60.

Another specimen (skinned from alcohol and therefore slightly different in color, being whiter beneath and duller olive above) measures as follows: Wing, 2.65; tail, 1.58; culmen, 0.69; width of mandible at base, 0.28; depth of bill at base, 0.31; tarsus, 0.90; middle toe, 0.60.

The type specimen, besides having a much darker bill, shows several distinct oblique sulcations on the sides of the mandible.

Family ICTERIDÆ.

Genus DOLICHONYX, Swainson.

Dolichonyx, SWAINSON, Philos. Mag., I, June, 1827, p. 435. Type, *Fringilla oryzivora*, Linnæus.

Range.—Eastern North America, migrating to tropical America in winter. Galapagos Archipelago (accidental during migration).

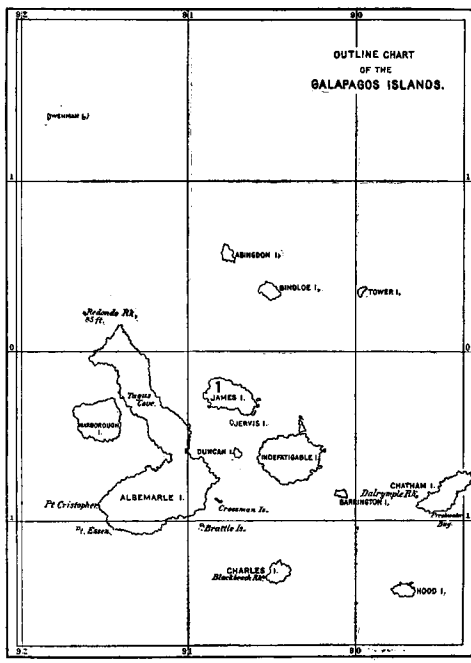
DOLICHONYX ORYZIVORUS (Linnæus).

Fringilla oryzivora, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 179.

Dolichonyx oryzivorus, SWAINSON, Zool. Jour., III, 1827, p. 351.—DARWIN, Zool. Voy. Beagle, III, Birds, 1841, p. 106 (James Island, Galapagos Archipelago).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 491 (James Island, Galapagos Archipelago).—BAIRD, BREWER, and RIDGWAY, Hist. N. Amer. Birds, II, 1874, p. 149.—RIDGWAY, Man. N. Amer. Birds, 1887, p. 366.

Range.—Temperate North America east of the Rocky Mountains, breeding northward; in winter, West Indies and parts of eastern South America. Accidental in the Galapagos Archipelago (James Island, Darwin).

ASCERTAINED RANGE OF THE GENUS DOLICHONYX, SWAINSON, IN THE GALAPAGOS ARCHIPELAGO.



1. *Dolichonyx oryzivorus* (Linnæus).

Family TYRANNIDÆ.

Genus MYIARCHUS, Cabanis.

Myiarchus, CABANIS, Fauna Peruana, Aves, 1844–1846, p. 152. Type, *Muscicapa ferox*, Gmelin.

Range.—The whole of temperate and tropical America. Galapagos Archipelago (one peculiar species, constituting a peculiar subgenus).

Subgenus ERIBATES, Ridgway.

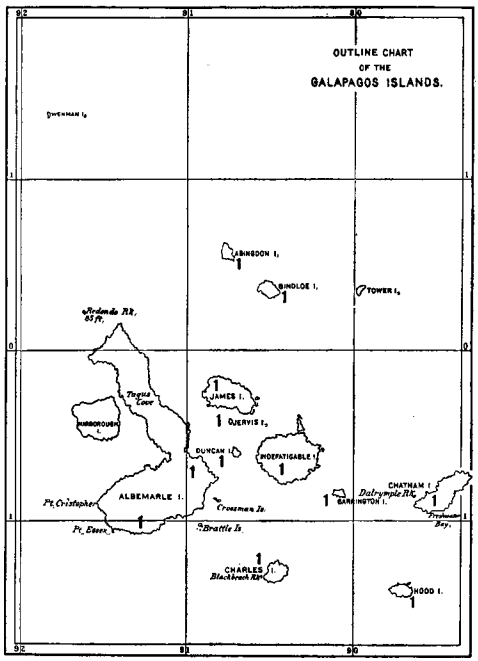
Eribates, RIDGWAY, Proc. U. S. Nat. Mus., XVI, No. 955, Oct. 5, 1893, p. 606. Type, *Myiobius magnirostris*, Gray.

Subgeneric characters.—Tarsus as long as the bill from the rictus; lateral outlines of bill not contracted terminally. Otherwise similar to the subgenus *Onychopterus*.[1]

[1] *Onychopterus*, Reichenbach, Av. Syst. Nat., 1850, pl. LXV. Type, *Tyrannus tuberculifer*, D'Orbigny and Lafresnaye.

Range.—Confined to the Galapagos Archipelago, where represented by a single species.

ASCERTAINED RANGE OF THE GENUS MYIARCHUS, CABANIS, IN THE GALAPAGOS ARCHIPELAGO.



1. *Myiarchus magnirostris* (Gray).

MYIARCHUS MAGNIROSTRIS (Gray).

Myiobius magnirostris, GRAY, in Zool. Voy. Beagle, III, Birds, 1841, p. 48 (Chatham Island, Galapagos Archipelago).

Tyrannula magnirostris, GOULD, Zool. Voy. Beagle, III, Birds, 1841, pl. VIII.

Myiarchus magnirostris, SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Indefatigable, Bindloe, and Abingdon islands).—SUNDEVALL, Proc. Zool. Soc., 1871, pp. 125, 127 (Charles and James islands).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 493 (Chatham, James, Indefatigable, Bindloe, and Abingdon islands).—SCLATER, Cat. Birds Brit. Mus., XIV, 1888, p. 262 (Bindloe, Indefatigable, and Abingdon islands).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 113 (Chatham, James, Indefatigable, Abingdon, Duncan, Hood, and Charles islands).

Empidonax magnirostris, BAIRD, BREWER, and RIDGWAY, Hist. N. Amer. Birds, II, 1874, p. 365.

Specific characters.—Above plain brown (varying from light olive-brown to deep grayish sepia), the wings and tail dusky with paler margins to the feathers (very pale on wing-coverts and tertials), the inner webs of rectrices (especially middle ones) more or less broadly edged with cinnamon-rufous or pale wood brown; chin, throat, and chest pale gray;[1] rest of under parts pale straw yellow or primrose yellow. Wing, 2.50–2.92; tail, 2.20–2.68; tarsus, 0.81–0.90.

Range.—Galapagos Archipelago: Albemarle Island (Baur and Adams); Duncan Island (*Albatross*, Baur and Adams); Charles Island (Kinberg, Townsend, Baur and Adams); Hood Island (*Albatross*, Baur and Adams); Chatham Island (Darwin, Kinberg, Townsend, Baur and Adams); Barrington Island (Baur and Adams); Indefatigable Island (Habel, *Albatross*, Baur and Adams); Jervis Island (Baur and Adams); James Island (Kinberg, *Albatross*, Baur and Adams); Bindloe Island (Habel); Abingdon Island (Habel, *Albatross*).

Adult male.—No. 90554, U.S.N.M.; Indefatigable Island, between September and October 16, 1868; Dr. A. Habel. Above plain grayish olive, slightly browner on pileum, paler and more olivaceous on rump; upper tail-coverts broccoli brown, slightly tinged with wood brown; wings and tail dusky, the middle and greater wing-coverts broadly tipped (the latter also narrowly edged) with pale hair brown, the tertials broadly margined with the same; the other remiges narrowly edged with a darker shade of the same; outer webs of rectrices edged with pale olive, the outer web of exterior feathers inclining to pale hair brown; inner webs of second to fifth rectrices with inner half (approximately) dull cinnamon-rufous. Chin and throat pale gray, the chest similar, but tinged with pale yellowish; rest of under parts pale straw yellow or primrose yellow. Bill black, the mandible paler at base; legs and feet brownish black. Length (skin), 5.55; wing, 2.80; tail, 2.50; exposed culmen, 0.57; maxilla from nostril, 0.45; tarsus, 0.87; middle toe, 0.38.

Adult female.—No. 115922, U.S.N.M.; Charles Island, April 8, 1888; C. H. Townsend. Similar to the adult male, as described above, but upper parts darker and more uniform olivaceous, gray of chest less tinged with yellow, and with less cinnamon-rufous on inner webs of rectrices, this color being mainly confined to the fourth and fifth feathers, with more on the second. Length (skin), 5.80; wing, 2.72; tail, 2.50; exposed culmen, 0.55; maxilla from nostril, 0.43; tarsus, 0.83; middle toe, 0.40.

Young male.—No. 116132, U.S.N.M.; Abingdon Island, April 16, 1888; C. H. Townsend. Essentially like the adult, but wing-bars narrower and more yellowish, edges of remiges (except tertials and outermost primaries) light cinnamon, and with more cinnamon-rufous on the tail, the inner webs of all the rectrices mainly of this color, except the outermost, on which it occupies nearly the inner half, all the rectrices except the outermost margined terminally with rusty.

[1] Intermediate between "smoke gray" and gray No. 8.

Although the series of 45 specimens examined exhibits some very perceptible variations in colors and dimensions, these appear to be chiefly of an individual character. Many of the specimens, however, are in worn or molting plumage, and the various islands are represented so unequally that the comparison can not be considered a satisfactory one. In the three adults from Abingdon Island (obtained April 16, 1888) the inner webs of the rectrices are broadly edged with pale pinkish buff, instead of cinnamon-rufous, but these were skinned from alcohol, the action of which may have extracted or destroyed the rufous color. At any rate, two young birds from Abingdon have as much and as bright rufous on the rectrices as those from other islands.

Measurements of Myiarchus magnirostris.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Exposed culmen.	Bill from nostril.	Tarsus.	Middle toe.
116153	U. S.	Adult female.	Abingdon Island	Apr. 16, 1888	2.73	2.30	0.60	0.46	0.84	0.41
135694	U. S.	Adult.....	.....do	.....do	.....	.....	.58	.47	.87	.....
135695	U. S.	.....do	.....do	.....do	2.62	2.30	.55	.46	.83	.40
116012	U. S.	Adult female .	James Island	Apr. 11, 1888	2.73	2.45	.60	.45	.85	.45
116011	U. S.	.....do	.....do	.....do	.....	.....	.60	.45	.90	.40
116013	U. S.	.....do	.....do	.....do	2.65	2.45	...	.50	.84	.40
116014	U. S.	.....do	.....do	.....do	2.75	2.55	.58	.43	.83	.40
546	B. & A.	Adult male ...	.....do	Aug. 16, 1891	2.80	2.63	.58	..	.87	.35
541	B. & A.	.....do	.....do	.....do	2.70	2.43	.51	....	.87	.32
			Average	.....	2.71	2.44	.58	.46	.86	.39
484	B. & A.	Adult female .	Jervis Island	Aug. 8, 1891	2.70	2.55	.57	....	.87	.32
115896	U. S.	.....do	Duncan Island.....	Apr. 13, 1888	2.85	.....	.59	.45	.....	.....
125987	U. S.	.....do	.....do	Apr. 2, 1891	.....	.....	.57	.43	.83	.40
115894	U. S.	.....do	.....do	Apr. 13, 1888	.....	.....	.....	.41	.84	.39
115895	U. S.	.....do	.....do	.....do	2.68	2.38	....	.42	.85	.36
115897	U. S.	Adult male	.....do	.....do	.....	.....	.61	.45	.85	.40
			Average	.....	2.77	2.38	.57	.43	.84	.39
90554	U. S.	.....do	Indefatigable Island.	.....	2.80	2.50	.57	.45	.87	.....
116052	U. S.	.....do	.....do	Apr. 12, 1888	2.88	2.65	.54	.44	.90	.38
424	B. & A.	.....do	.....do	Aug. 5, 1891	2.71	2.58	.60	....	.83	.40
426	B. & A.	.....do	.....do	.....do	2.77	2.40	.56	....	.90	.38
427	B. & A.	.....do	.....do	.....do	2.78	2.62	.51	....	.81	.41
428	.....	.....do	.....do	.....do	2.80	2.58	.55	....	.82	.39
			Average	.....	2.79	2.55	.56	.45	.85	.39
115959	U. S.	.....do	Chatham Island	Apr. 5, 1888	2.72	2.45	.58	.45	.85	.38
115960	U. S.	Adult female.	.....do	.....do	2.50	2.20	.59	.43	.83	.38
125982	U. S.	.....do	.....do	Mar. 30, 1891	2.53	2.28	.52	.42	.82	.35
119	B. & A.	Adult male....	.....do	June 25, 1891	2.70	2.50	.58	....	.85	.35
α	B. & A.	.....do	.....do	June 13, 1891	2.74	2.36	.57	....	.81	.39
β	B. & A.	.....do	.....do	June 12, 1891	2.83	2.45	.58	....	.88	.40
γ	B. & A.	.....do	.....do	June 11, 1891	2.78	2.47	.58	....	.89	.35
			Average	.....	2.69	2.39	.57	.43	.85	.37
116079	U. S.	.....do	Hood Island.....	Apr. 7, 1888	2.92	2.60	.57	.47	.88	.41
116080	U. S.	Adult female.	.....do	.....do	2.75	2.58	.55	.43	.85	.40
149842	U. S.	Adult male....	.....do	.....do	2.88	2.61	.58	.49	.85	.....
149843	U. S.	Adult	.....do	.....do	2.74	2.50	.55	.46	.82	.....
149844	U. S.	.....do	.....do	.....do	2.70	2.53	.58	.46	.85	.40
149845	U. S.	.....do	.....do	.....do	2.87	2.60	.58	.45	.87	.43
149846	U. S.	.....do	.....do	.....do	2.87	2.55	.59	.48	.90	.....
			Average.....	.....	2.82	2.57	.57	.46	.86	.41
115921	U. S.	Adult female.	Charles Island	Apr. 8, 1888	2.90	2.68	.52	.45	.89	.40
115922	U. S.	.....do	.....do	.....do	2.72	2.50	.55	.43	.83	.40
125986	U. S.	Adult.....	.....do	Apr. 1, 1891	2.72	2.37	.55	.43	.87	.40
			Average.....	.....	2.78	2.52	.54	.44	.86	.40

Genus PYROCEPHALUS, Gould.

Pyrocephalus, GOULD, Zool. Voy. Beagle, III, Birds, 1841, p. 44. Types, "*Pyrocephalus parvirostris* (Gould) and *Muscicapa coronata* (Auct?)."[1]

Range.—The whole of tropical and subtropical America, except West Indies, southern Florida, and parts of Central America. Galapagos Archipelago (several peculiar species or local forms).

KEY TO THE GALAPAGOS FORMS OF THE GENUS PYROCEPHALUS, GOULD.

a^1. Adult males with back, etc., very dark brown, sometimes almost black; larger. Wing, 2.27–2.60; tail, 1.94–2.20; exposed culmen, 0.40–0.50; tarsus, 0.70–0.76.

b^1. Adult males pure red beneath.

c^1. Adult females clear yellow beneath.

d^1. Adult female with under parts light naples yellow. (James Island.) 1. *P. nanus* (p. 572).

d^2. Adult female with under parts light chrome yellow or deep naples yellow; top of head more tinged with yellow; upper parts browner. (Indefatigable and Albemarle islands).....2. *P. intercedens* (p. 575).

c^2. Adult females buff beneath. (Charles Island)....3. *P. carolensis* (p. 576).

b^2. Adult male orange-red beneath. (Abingdon Island; Bindloe Island?.) 4. *P. abingdoni* (p. 578).

a^2. Adult male with back, etc., lighter grayish brown; smaller. Wing, 2.08–2.37; tail, 1.80–2.05; exposed culmen, 0.35–0.42; tarsus, 0.62–0.73. (Chatham Island).....5. *P. dubius* (p. 579).

I am well aware of the very unsatisfactory character of the above key, but I have very few specimens at hand from which to construct it, Dr. Baur's larger series having been returned to him. Furthermore, the difference between the several forms is most obvious in the females, and of *P. abingdoni*, the only one excepting the very distinct *P. dubius*, in which the adult male is noticeably different, the female is still unknown.[2] With the exception of *P. dubius*, Gould, of Chatham Island, which is sufficiently distinct, in my opinion, to hold specific rank, the other forms may properly be considered as merely local races of *P. nanus*, more or less differentiated, the differentiation most marked in *P. carolensis* and *P. abingdoni*.

PYROCEPHALUS NANUS, Gould.

Pyrocephalus nanus, GOULD, Zool. Voy. Beagle, III, Birds, 1841, p. 45, pl. VII (Galapagos Archipelago).—SUNDEVALL, Proc. Zool. Soc., 1871, p. 125 (part) (James Island).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 112 (part) (James Island).

Specific characters.—Adult male with pileum and under parts uniform bright vermilion red, the sides of head and upper parts plain blackish

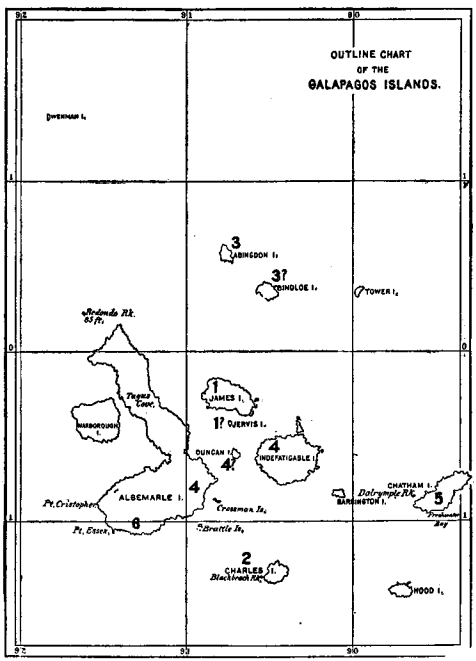
[1] = *Muscicapa rubina*, Boddært (1783), *M. coronata*, Gmelin (1788).

[2] The adult females whose measurements are given on page 579 were skinned from alcohol and have their coloration so radically changed that they are unfit for comparison in this respect. It may be remarked that the red of the adult males is wholly destroyed by the immersion in alcohol.

brown, the rectrices paler and more grayish, especially the lateral pair; adult female hair brown above, light naples yellow beneath, with chin and throat white.

Range.—Galapagos Archipelago: James Island (Darwin?, Kinberg, Townsend, Baur and Adams).

ASCERTAINED RANGE OF THE GENUS PYROCEPHALUS, GOULD, IN THE GALAPAGOS ARCHIPELAGO.



1. *Pyrocephalus nanus*, Gould.
2. *Pyrocephalus carolensis*, Ridgway.
3. *Pyrocephalus abingdoni*, Ridgway.
4. *Pyrocephalus intercedens*, Ridgway.
5. *Pyrocephalus dubius*, Gould.
6. (Undetermined form.)

Adult male.—No. 116015, U.S.N.M.; James Island, April 11, 1888; C. H. Townsend. Pileum intense poppy red, lighter and more scarlet anteriorly; rest of upper parts, together with a broad band along side of head (including lores, suborbital region, and auricular region) connecting with color of hind neck, plain dark sooty brown or clove brown, becoming rather lighter on wings and tail, especially the latter, the outermost rectrices rather pale brownish gray. Under parts rich scarlet-vermilion, paler (flesh pink) on throat and under tail-coverts, the chin whitish. Maxilla brownish black, mandible dark brown; legs

and feet black. Length (skin), 4.90; wing, 2.60; tail, 2.10; exposed culmen, 0.45; tarsus, 0.73; middle toe, 0.40.

Immature male (second year?).—No. 116017, U.S.N.M.; same locality, date, etc. Pileum mixed dark brown, orange-yellow, and poppy red, the latter chiefly on hinder part of crown; general color of rest of upper parts grayish sepia (much paler than in adult male); chin, throat, and upper chest white with a few pink feathers intermixed; rest of under parts mainly flesh pink, intermingled with deeper red (flame scarlet) and light yellow (naples yellow) feathers, the latter chiefly on the breast. Length (skin), 4.90; wing, 2.50; tail, 2.08; exposed culmen, 0.41; tarsus, 0.73; middle toe, 0.40.

Adult female.—No. 116018, U.S.N.M.; same locality, date, etc. Above, including sides of head, deep hair brown, less uniform on pileum, where the feathers are darker medially, paler on edges, and light colored basally, producing an indistinct streaked appearance, the forehead tinged with yellow; chin, throat, and malar region plain white; rest of under parts uniform clear maize yellow, the sides of the chest with a few streaks of light grayish brown. Bill, legs, and feet as in adult and immature male. Length (skin), 5.10; wing, 2.48; tail, 2.15; exposed culmen, 0.43; tarsus, 0.74; middle toe, 0.43.

Immature male.—No. 515, collection of Dr. G. Baur; James Island, August 13, 1891. Similar to the adult female, as described above, but decidedly darker, and with the top of the head similar to the back—that is, uniform dusky brown, with a few concealed yellowish spots in middle of crown; under parts paler yellow, very much paler on chest, where more distinctly (though still slightly) streaked with dusky. Wing, 2.45; tail, 2; exposed culmen, 0.40; tarsus, 0.70; middle toe, 0.40.

Young male.—No. 116019, U.S.N.M.; James Island, April 11, 1888; C. H. Townsend. Above brownish black or very dark blackish brown, the feathers narrowly margined with dull pale buffy, producing an indistinct squamate appearance, the feathers of the rump with broad tips of tawny buff, producing a nearly uniform patch of this color; middle and greater wing-coverts tipped with tawny buff, producing two rather narrow but very distinct bands across the wing; rectrices narrowly tipped with dull white. A narrow supraloral stripe, extending to above the eye, dull light yellowish; chin and throat dull yellowish white, tinged laterally with brownish gray; rest of under parts light naples yellow, the chest narrowly but distinctly streaked with dusky. Bill, legs, and feet colored as in adults.

Measurements of Pyrocephalus nanus.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
116015	U. S.	Adult male	James Island	Apr. 11, 1888	2.60	2.10	0.45	0.73	0.40
563	B. & A.	do	do	Aug. 17, 1891	2.58	2.15	.40	.73	.42
116017	U. S.	Immature male	do	Apr. 11, 1888	2.50	2.08	.41	.73	.40
515	B. & A.	do	do	Aug. 13, 1891	2.45	1.85	.45	(.82)	.40
584	B. & A.	Adult female	do	Aug. 18, 1891	2.44	2.13	.40	.73	(.34)
116018	U. S.	do	do	Apr. 11, 1888	2.48	2.15	.43	.74	.43
			Average		2.51	2.07	.42	.73	.41

PYROCEPHALUS INTERCEDENS, Ridgway.

Pyrocephalus nanus (nec GOULD), SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (part: Indefatigable Island).—SUNDEVALL, Proc. Zool. Soc., 1871, p. 125 (part: Indefatigable Island).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 492 (part: descriptions).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 112 (Indefatigable Island).

Pyrocephalus intercedens, RIDGWAY, Proc. U. S. Nat. Mus., XVII, No. 1007, Nov. 15, 1894, p. 366 (Indefatigable Island, Galapagos Archipelago; collection of Dr. G. Baur).

Specific characters.—Similar to *P. nanus*, Gould, of James Island, but female much brighter yellow beneath, browner above, and top of head more tinged with yellow.

Range.—Galapagos Archipelago: Albemarle Island (Baur and Adams); Indefatigable Island (Darwin?, Kinberg, Habel, *Albatross*, Baur and Adams).

Adult male.—Type, No. 418, collection of Dr. G. Baur; Indefatigable Island, August 5, 1891. Pileum rich poppy red, the feathers paler beneath the surface and white basally; rest of upper parts, together with a band along side of head, involving lores, suborbital region and auricular region brownish black or very dark blackish brown. Chin, throat, and chest rich scarlet-vermilion, the remaining under parts more orange-red, or flame scarlet—all the feathers of the under parts white basally. Bill black, the mandible more brownish; legs and feet black. Wing, 2.58; tail, 2.18; exposed culmen, 0.47; tarsus, 0.75; middle toe, 0.58.

Adult female.—No. 439, collection of Dr. G. Baur; Indefatigable Island, August 6, 1891. Above deep hair brown, the pileum strongly tinged with yellow; superciliary stripe, extending from nostrils to posterior angle of eye (broadest anteriorly), light buff-yellowish; malar region, chin, and throat very pale maize yellow; rest of under parts light chrome, or deep naples yellow. Wing, 2.38; tail, 2; exposed culmen, 0.40; tarsus, 0.70.

Immature male.—No. 463, same collection; Indefatigable Island, August 7. Very similar to the adult female, but rather darker above; chin and throat white, faintly tinged with maize yellow; rest of lower parts rather deeper and decidedly "warmer" yellow than in the adult female (a very pale tint of "deep chrome"), rather paler on the chest, where marked with very narrow shaft-streaks of dusky. Wing, 2.52; tail, 2.05; exposed culmen, 0.45; tarsus, 0.71; middle toe, 0.40.

An immature male (No. 77764, U.S.N.M.; Indefatigable Island, August 25–October 16, Dr. A. Habel) is similar to that described above, but has the yellow of the chest equally deep with that of more posterior under parts (the whitish throat being thereby more abruptly defined) and the fine dusky streaks nearly obsolete. Wing, 2.40; tail, 2.02; exposed culmen, 0.45; tarsus, 0.70; middle toe, 0.39.

Young.—No. 116053, U.S.N.M.; Indefatigable Island, April 12; C. H.

Townsend. Above dark grayish brown, the feathers of the back, the scapulars, and the lesser wing-coverts narrowly and rather indistinctly margined with paler; those of the rump and upper tail-coverts much more broadly margined with brownish buff, which constitutes the prevailing color; top of head broadly streaked with dusky on a whitish and pale buffy ground, the forehead chiefly pale buffy; middle and greater wing-coverts broadly tipped with pale brownish buffy, producing two wing-bands; tail feathers also broadly tipped with pale dull buffy; remiges rather broadly margined at tips with whitish. Supraloral region, malar region, chin, and throat whitish, tinged with dull yellowish; rest of under parts light naples yellow, the chest, sides, and flanks longitudinally flecked with grayish brown.

An adult male in Dr. Baur's collection from Albemarle Island (No. 383, July 29) is quite identical in coloration with that described from Indefatigable Island. Wing, 2.51; tail, 2.07; exposed culmen, 0.43; tarsus, 0.70; middle toe, 0.40.

An adult male from North Albemarle (No. 499, August 10) is similar as to color of back, etc., but has the red of the pileum and chest more intense. Wing, 2.58; tail, 215; exposed culmen, 0.45; tarsus, 0.72; middle toe, 0.40.

Measurements of Pyrocephalus intercedens.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
418	B. & A.	Adult male	Indefatigable Island.	Aug. 5, 1891	2.50	2.12	0.43	0.76	0.37
463	B. & A.	do	do	Aug. 7, 1891	2.50	2.05	.44	.72	(.33)
77763	U. S.	do	do		2.55	2.10	.45	.71	.40
77764	U. S.	Adult female	do		2.42	2.02	.44	.73	.41
439	B. & A.	do	do	Aug. 6, 1891	2.27	1.94	.40	(.80)	.33
			Average		2.45	2.05	.43	.73	.38
383	B. & A.	Adult male	North Albemarle Island.	July 29, 1891	2.50	2.18	.44	(.85)	(.35)
499	B. & A.	do	do	do	2.60	2.04	.44	.72	.46
			Average		2.55	2.11	.44	.72	.46

PYROCEPHALUS CAROLENSIS, Ridgway.

Pyrocephalus nanus (nec GOULD), SHARPE, Proc. Zool. Soc., 1877, p. 66 (Charles Island).—SALVIN, Proc. Zool. Soc., 1883, p. 424 (Charles Island).—SCLATER, Cat. Birds Brit. Mus., XIV, 1888, p. 214 (part: Charles Island).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889 (1890), p. 112 (Charles Island).

Pyrocephalus carolensis, RIDGWAY, Proc. U. S. Nat. Mus., XVII, No. 1007, Nov. 15, 1894, p. 365 (Charles Island, Galapagos Archipelago; collection U. S. Nat. Mus.).

Specific characters.—Similar to *P. nanus*, Gould (from James Island), but female deep buff beneath, instead of clear light naples yellow, and upper parts browner.

Range.—Galapagos Archipelago: Charles Island (Darwin, Cookson, Townsend, Baur and Adams).

Adult male.—No. 115926, U.S.N.M.; Charles Island, April 8; C. H. Townsend. Lores, ear coverts, occiput, hind neck, and remaining upper parts uniform blackish brown,[1] becoming lighter, more grayish, brown on lower rump, upper tail-coverts, and tips of wing-coverts, the edges of the secondaries still paler, and tips of secondaries, innermost primaries, and tail-feathers pale grayish brown, passing on terminal margins into brownish white; outermost tail-feather pale grayish brown, its outer web slightly paler and faintly tinged with pink. Entire pileum glossy dark vermilion; lower parts scarlet-vermilion, paler posteriorly (flesh color on under tail-coverts), deepest on breast, and on throat somewhat broken by exposure of white bases of the feathers; under wing-coverts and axillars flesh color, the former mixed with dusky. Bill black, the mandible somewhat brownish basally; legs and feet black. Length (skin), 4.85; wing, 2.50; tail, 2; exposed culmen, 0.42; tarsus, 0.72; middle toe, 0.40.

Immature male.—No. 115927, U.S.N.M.; Charles Island, April 8; C. H. Townsend. Above dusky brown (very much paler than in adult), paler and grayer on rump and upper tail-coverts, many of the feathers of lower back and scapulars showing very indistinct and narrow paler tips; wings and tail as in the adult, but the former rather paler; forehead and fore part of crown whitish, tinged with flesh pink (especially near nostrils), each feather marked with a rather broad mesial streak of dusky brown, the hinder part of crown nearly uniform dusky, but the feathers light vermilion or flesh red beneath the surface. Lores and orbits dusky, the ear coverts paler and faintly tinged with flesh pink; chin, throat, and malar region white, very faintly tinged with flesh pink, especially on chin; rest of under parts flesh color, deepest on flanks, paler on chest and breast, where narrowly streaked with dusky. Bill and feet as in adult. Length (skin), 5; wing, 2.60; tail, 2.03; exposed culmen, 0.45; tarsus, 0.71.

Adult female.—No. 115928, U.S.N.M.; same date, etc. Above grayish olive, becoming gradually paler and more grayish (nearly "hair brown") on rump and upper tail-coverts; crown somewhat streaked with paler; forehead, superciliary region, and malar region whitish, tinged with buffy yellowish. Chin and throat buffy white; rest of under parts deep buff-yellow, the chest marked with a few very indistinct dusky streaks. Bill and feet as in the male. Length (skin), 4.80; wing, 2.50; tail, 2.05; exposed culmen, 0.48; tarsus, 0.70; middle toe, 0.40.

An adult male in more worn plumage (No. 125988, U.S.N.M.; Charles Island, April 1; C. H. Townsend) is, through fading, a more pronounced brown color above than the example described above. The two other adult females show no trace of streaks on the chest.

[1] A little darker and warmer than "clove brown."

Measurements of Pyrocephalus carolensis.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
115924	U. S.	Adult male	Charles Island	Apr. 8, 1888	2.57	2.03	0.47	0.70	0.37
115925	U. S.	do	do	do	2.65	2.05	.45	.72	.40
115926	U. S.	do	do	do	2.50	2.00	.42	.72	.40
125988	U. S.	do	do	Apr. 1, 1891	2.60	2.05	.47	.70	.43
115927	U. S.	Immature male	do	Apr. 8, 1888	2.60	2.03	.45	.71	.43
115928	U. S.	Adult female	do	do	2.50	2.05	.48	.70	.40
115929	U. S.	do	do	do	2.51	2.05	.45	.70	.44
			Average		2.55	2.04	.45	.71	.41

PYROCEPHALUS ABINGDONI, Ridgway.

Pyrocephalus nanus (nec GOULD), RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 112 (part) (Abingdon Island).

Pyrocephalus abingdoni, RIDGWAY, Proc. U. S. Nat. Mus., XVII, No. 1007, Nov. 15, 1894, p. 357 (Abingdon Island, Galapagos Archipelago; collection U. S. Nat. Mus.).

Specific characters.—Similar to *P. carolensis*, Ridgway, of Charles Island, in color of back, etc., but red of under parts very different—flame scarlet or orange chrome instead of vermilion. (Female and young unknown.)

Range.—Galapagos Archipelago: ? Bindloe Island (Habel, Baur and Adams); Abingdon Island (Townsend).

Adult male.—Type, No. 116134, U.S.N.M.; Abingdon Island, Galapagos, April 16, 1888; C. H. Townsend. Pileum intense scarlet or scarlet-vermilion, paler, more orange-red, on forehead; entire under parts orange-red ("orange chrome"), the under tail-coverts paler, inclining to salmon color; ear-coverts, hind neck, back, etc., clove brown (very nearly same color as in *P. carolensis*). Length (skin), 4.95; wing, 2.55 (?); tail, 2.10 (?); exposed culmen, 0.48; width of bill at base, 0.23; tarsus, 0.75.

Another adult male (No. 116135, U.S.N.M.; same date, etc.) is similar, but has the pileum deeper red (intense vermilion) and the fore neck and chest slightly tinged with vermilion. Exposed culmen, 0.45; width of bill at base, 0.25; tarsus, 0.73. (Wing and tail too imperfect for measurement.)

An adult male from Bindloe Island in Dr. Baur's collection is similar in color of back, etc., to these Abingdon examples, but the under parts are very different, the anterior half being pure scarlet and the posterior half very abruptly pale saturn red. The bill is also extremely narrow. Whether the differences are of an individual character or characteristic of the locality can not be determined from only one specimen. Length (skin), 4.40; wing, 2.48; tail, 2.12; exposed culmen, 0.40; width of bill at base, 0.20; tarsus, 0.67.

Measurements of Pyrocephalus abingdoni.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
116134	U. S.	Adult male	Abingdon Island	Apr. 16, 1888	(2.55)	(2.10)	0.48	0.75	0.42
116135	U. S.	do	do	do			.45	.73	.41
135698	U. S.	do	do	do	(2.60)	(2.13)	.45	.77	.42
135699	U. S.	do	do	do			.48	.76	
135700	U. S.	do	do	do	(2.55)		.45	.72	.43
149802	U. S.	do	do	do			.45	.70	.44
149803	U. S.	do	do	do			.48	.75	
149801	U. S.	Immature male	do	do	(2.50)	2.20	.48	.72	
149804	U. S.	Adult female	do	do	(2.48)	2.00	.50	.74	.43
149805	U. S.	do	do	do	(2.45)	(1.95)	.47	.70	
149806	U. S.	do	do	do	2.45	2.17	.49	.70	.45
149807	U. S.	do	do	do				.74	.42
			Average		2.45	2.12	.47	.73	.43

PYROCEPHALUS DUBIUS, Gould.

Pyrocephalus dubius, GOULD, Zool. Voy. Beagle, Birds, 1841, p. 46 (Galapagos Archipelago).—RIDGWAY, Proc. U. S. Nat. Mus., XVII, 1894, p. 368 (Chatham Island; descriptions, synonymy, etc.).

Pyrocephalus nanus (nec GOULD), AUCTORUM, part.

Pyrocephalus minimus, RIDGWAY, Proc. U. S. Nat. Mus., XII, No. 767, Feb. 5, 1890, p. 113, in text (Chatham Island, Galapagos Archipelago; collection U. S. Nat. Mus.).

Specific characters.—Decidedly smaller than *P. nanus*, Gould, and other Galapagoan forms; adult male with lower parts conspicuously paler and duller red than pileum; back, etc., lighter and browner than in other forms; adult female with conspicuous superciliary stripe and under parts deep ochraceous-buff, the throat paler, but scarcely approaching white.

Range.—Galapagos Archipelago: Chatham Island (Darwin?, Townsend, Baur and Adams).

Adult male.—No. 72, collection of Dr. G. Baur; Chatham Island, June 18, 1891. Entire pileum glossy dark vermilion, exactly as in other forms; lower parts pale scarlet, deepest on breast, much paler on throat, and still more so on chin, which inclines to reddish white. Lores, ear coverts, and upper parts in general deep brown (intermediate between "seal" and "clove"), decidedly lighter and browner than in other forms; tips of wing-coverts, edges of secondaries, and whole of outer tail-feathers paler, more grayish, brown. Length (skin), 4.35; wing, 2.23; tail, 1.90; exposed culmen 0.38; tarsus, 0.65; middle toe, 0.35.

Nearly adult male.—Specimen marked "B," collection of Dr. G. Baur; Chatham Island, June 16. Much like the fully adult male, as described above, but red of pileum paler and mixed with many partly brown feathers, that of under parts very much paler (deep salmon color, very much paler on chin and throat), and upper parts decidedly lighter warm grayish brown. Wing, 2.28; tail, 2.05; exposed culmen, 0.36; tarsus, 0.65; middle toe, 0.35.

Adult female.—No. 63, collection of Dr. G. Baur; Chatham Island,

June 17. Forehead and broad superciliary stripe, extending from nostrils to occiput, ochraceous-buff; rest of pileum nearly same color, but broadly streaked with deep hair brown, these streaks so broad on hind part of crown as to nearly conceal the buffy edgings. Ear coverts, hind neck, back, scapulars, and lesser wing-coverts uniform hair brown, the rump, upper tail-coverts, and broad tips of greater and middle wing-coverts paler and tinged with buffy; secondaries edged for terminal half with pale buffy grayish, and broadly margined at tips with buffy grayish white. Malar region, chin, and throat pale buff, deeper laterally; rest of under parts deep buff, becoming rather clearer and brighter posteriorly, and everywhere devoid of the least trace of streaks. Length (skin), 4.25; wing, 2.21; tail, 1.88; exposed culmen, 0.38; tarsus, 0.65; middle toe, 0.32.

Immature male.—No. 123, collection of Dr. G. Baur; Chatham Island, June 25. Much like the adult female, as described above, but top of head nearly uniform grayish brown, like back, though showing indistinctly defined broad streaks of darker and lighter, with a few concealed bright yellow spots on center of crown; anterior part of forehead and superciliary stripe, however, deep buffy, as in the female; buff of under parts deeper and yellower. Length (skin), 4.25; wing, 2.30; tail, 1.92; exposed culmen, 0.39; tarsus, 0.63; middle toe, 0.38.

The adult male described is the brightest colored one in a series of eight, the remainder being more or less paler scarlet beneath. This conspicuous difference of intensity between the red of the pileum (which is exactly as in other forms) and that of the lower parts is, next to the small size, the most striking character of the present form.

Two other females in Dr. Baur's collection differ from that described in having an appreciable (though in case of one very faint) yellow tinge to the posterior under parts.

Another immature male, also in Dr. Baur's collection, is quite decidedly yellowish on the posterior lower parts, the under tail-coverts and malar region being nearly maize yellow.

There can be little doubt, I think, that Gould's *Pyrocephalus dubius* was based on a female or immature male of this form, but the question can be determined positively only by examination of the type, now in the British Museum. The original description certainly fits the female very well, and the measurements of the type, recently made for me by Dr. Sclater, indicate a very small bird; smaller, in fact, than the smallest in the series of sixteen specimens from Chatham Island.

Some of Dr. Sclater's measurements are materially different from those given by Gould, as the following will show. For convenience of comparison, the fractions of the latter are changed from duodecimals to decimals:

Measurements of Pyrocephalus dubius.

Authority.	Wing.	Tail.	Exposed culmen.	Tarsus.	Specimen.
Gould	2.26	1.77	.....	0.60	Type of *P. dubius*, Gould. No. 125989, U.S.N.M.
Sclater	2.15	1.60	0.40	.60	
Smallest female from Chatham Island.	2.20	1.80	.45	.62	

This very distinct form was separated by me, provisionally, from *P. nanus*, as *P. minimus*, in the paper above cited, without being described in detail. The fourteen specimens subsequently received bring out very strongly its distinctive characters, and show it to be very different indeed from *P. nanus* and its nearer allies, from which, in any plumage, specimens may be distinguished at a glance.

Measurements of Pyrocephalus dubius.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
115961	U. S.	Adult male	Chatham Island	Apr. 5, 1888	2.28	1.95	0.41	0.68	0.38
115962	U. S.	do	do	do			.40	.65	.39
125990	U. S.	do	do	Mar. 30, 1891	2.25	1.87		.67	.39
135664	U. S.	do	do	Apr. 4, 1888			.35	.67	.40
135665	U. S.	do	do	do	2.23	1.85		.68	.38
72	B. & A.	do	do	June 18, 1888	2.23	1.80	.39	.70	.36
93	B. & A.	do	do	June 20, 1888	2.29	2.02	.38	.72	.36
104	B. & A.	do	do	June 22, 1888	2.22	1.87	.38	.68	.38
105	B. & A.	do	do	do	2.35	1.98	.36	.70	.30
α	B. & A.	do	do	June 16, 1888	2.37	2.00	.39	.69	.35
β	B. & A.	do	do	do	2.32	2.05	.40	.73	.33
η	B. & A.	do	do	June 12, 1888	2.30	1.89	.42	.64	.37
γ	B. & A.	Immature male	do	June 16, 1888	2.28	1.93	.40	.86	.34
123	B. & A.	do	do	June 25, 1888	2.27	1.95	.40	.61	.34
δ	B. & A.	Adult female	do	June 16, 1888	2.26	1.97	.36	.73	.33
ε	B. & A.	do	do	do	2.08	1.91	.35	.68	.38
63	B. & A.	do	do	June 17, 1888	2.23	1.93	.36	.70	.35
125989	U. S.	do	do	Mar. 30, 1888	2.20	1.83	.42	.65	.38
135662	U. S.	do	do	Apr. 4, 1888	2.18	1.85	.38	.62	.35
135663	U. S.	Adult? female?	do	do	2.24	1.85	.35	.65	.39
			Average		2.23	1.92	.38	.70	.36

Family CUCULIDÆ.

Genus COCCYZUS, Vieillot.

Coccyzus, VIEILLOT, Analyse, 1816, p. 28. Type, *Cuculus americanus*, Linnæus.

Range.—Temperate and tropical America in general. Galapagos Archipelago (one species of wide range on South American continent).

COCCYZUS MELANOCORYPHUS, Vieillot.

Coccyzus melanocoryphus, VIEILLOT, Nouv. Dict. d'Hist.,Nat., VIII, 1817, p. 271.—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889 (1890), p. 113 (Chatham and Charles islands, Galapagos Archipelago).—SHELLY, Cat. Birds Brit. Mus., XIX, 1891, p. 307.

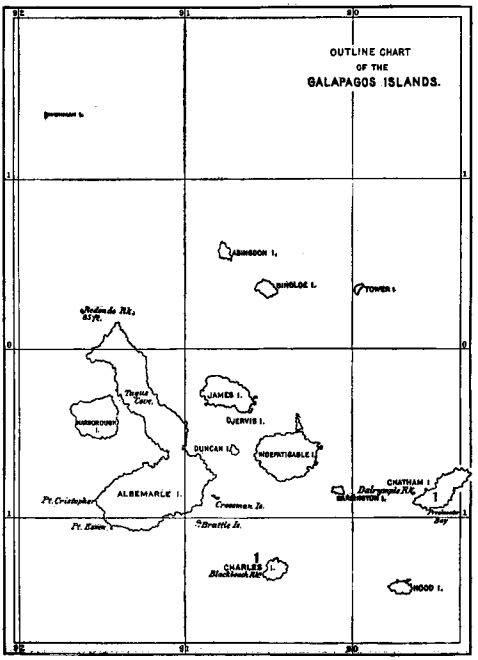
Range.—The greater part of South America; south to Argentine Republic and southern Brazil, north to Ecuador and Guiana. Galapagos Archipelago: Charles and Chatham islands (Townsend, Baur and Adams).

Chatham Island, male adult, April 5, 1888; Charles Island, male adult, April 8, 1888; immature male, April 1, 1891, and immature bird with sex undetermined, date same as the last; all collected by Mr. C. H. Townsend, naturalist of the United States Fish Commission steamer *Albatross*.

These specimens I am unable to distinguish from mainland examples,

though the adult male from Charles Island has the bill considerably deeper and broader at the base than any mainland specimens with which I have been able to compare it.

ASCERTAINED RANGE OF THE GENUS COCCYZUS, VIEILLOT, IN THE GALAPAGOS ARCHIPELAGO.



1. *Coccyzus melanocoryphus*, Vieillot.

Measurements of the Galapagos specimens are as follows:

Measurements of Coccyzus melanocoryphus.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Exposed culmen.	Bill from nostril.	Tarsus.	Middle toe.
115930	U. S.	Adult male	Charles Island.	Apr. 8, 1888	4.55	5.35	0.95	0.43	1.11	0.72
125991	U. S.	Immature male	do	Apr. 1, 1891	4.42	5.20	.90	.42	1.05	.72
125992	U. S.	do	do	do	4.70	5.67	.95	.43	1.13	.75
115963	U. S.	Adult male	Chatham Island.	Apr. 5, 1888	4.62	5.68	.88	.45	1.05	.75
			Average		4.57	5.42+	.92	.43	1.08+	.74+

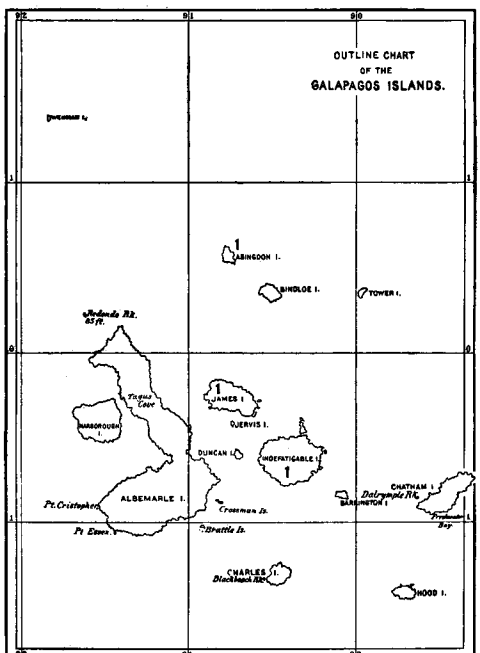
Family STRIGIDÆ.

Genus STRIX, Linnæus.

Strix, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 92. Type, by elimination, *S. aluco*, Linnæus (10th ed., nec ed. 12).

Range.—Cosmopolitan (except colder regions, New Zealand, and parts of Polynesia). Galapagos Archipelago (one peculiar species).

ASCERTAINED RANGE OF THE GENUS STRIX, LINNÆUS, IN THE GALAPAGOS ARCHIPELAGO.



1. *Strix punctatissima*, Gray.

STRIX PUNCTATISSIMA, Gray.

Strix punctatissima, G. R. GRAY, in Zool. Voy. Beagle, III, Birds, 1841, 34, pl. IV, (James Island, Galapagos Archipelago: collection British Mus.); Gen. Birds, I, 1844, p. 41; Hand-l., I, 1869, p. 52.—BONAPARTE, Consp. Av., I, 1850, p. 55.—KAUP, Contr. Orn., 1852, p. 118; Trans. Zool. Soc., IV, 1859, p. 246.—HARTLAUB, Jour. für Orn., 1854, p. 170.—STRICKLAND, Orn. Syn., I, 1855, p.

182.—SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Indefatigable Island); Nom. Av. Neotr., 1873, p. 116.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 494 (James, Indefatigable and Abingdon islands).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, pp. 120, 122, 123, 124 (James, Indefatigable, and Abingdon islands.)

Strix pratincola (nec BONAPARTE), SHARPE, Cat. Birds Brit. Mus., II, 1875, p. 291 (part).

Specific characters.—Much smaller and darker than any of the continental forms of the genus; face rich rusty brown, under parts rich tawny, more or less barred with dusky, and upper parts with blackish brown predominating.

Range.—Galapagos Archipelago: Indefatigable Island (Habel); James Island (Darwin); Abingdon Island (Habel).

"*Colour.*—Head and feathers within facial disk, glossy ferruginous brown, those forming the margin of it, same coloured, with their tips dark brown. Back of head and throat smoky brown, mottled with numerous small white dots, on the tips of the feathers. Back and wing-coverts the same, with the white spots larger and purer. Wings: Primaries same dark brown, mottled with dull chestnut red; the tip of each, with the exception of the three first, is marked with a triangular white spot, of the same kind with those over the rest of the body, but larger. Tail, transversely barred with brown and reddish fulvous, and the extreme points mottled with white. *Under surface.* Breast, belly and lining of wings, fulvous, mottled with brown;—the feathers being transversely barred with narrow brown lines. Under side of tail, pale gray, with well defined transverse bars of a darker gray. Short downy feathers on tarsi, of a brighter fulvous than the rest of the under surface.

"FORM.—Third primary rather longer than second; first equal to third. Wing, exceeding the tail in length by nearly one inch and a quarter. Short feathers on the tarsus, extending about one-third of its length, below the knee. Tarsi, elongated. Toes and lower part of tarsi, with few scattered brown hairs.

	In.		In.
"Total length	13¾	Tarsi	2 7/16
Wing	9¼	Tip of beak to rictus	1½
Tail	4¼	Middle toe, from root of claw to base	1 1/10

"Habitat, James Island, Galapagos Archipelago, (*October*).

"I am indebted to Mr. G. R. Gray for the description of this species, which is deposited in the British Museum. Only one specimen was obtained during our visit to the Galapagos Archipelago; and this formed part of the collection made by the direction of Captain FitzRoy.

"This owl is in every respect a true *Strix;* it is fully a third less than the common species of Europe, and differs from it in many respects, especially in the darker colouring of its plumage. The colouring of the Plate is not perfectly accurate in its minuter details." (Darwin.)

Neither Mr. Townsend nor Messrs. Baur and Adams met with this species on any of the islands.

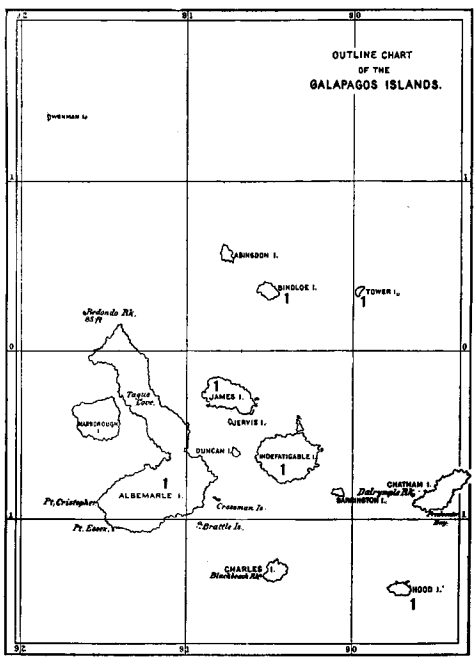
Family BUBONIDÆ.

Genus ASIO, Brisson.

Asio, BRISSON, Orn., I, 1760, p. 28. Type, *Strix otus*, Linnæus.

Range.—Nearly cosmopolitan (wanting in New Zealand and Australia and parts of Polynesia). Galapagos Archipelago (one peculiar species).

ASCERTAINED RANGE OF THE GENUS ASIO, BRISSON, IN THE GALAPAGOS ARCHIPELAGO.



1. *Asio galapagoensis* (Gould).

ASIO GALAPAGOENSIS (Gould).

Otus (*Brachyotus*) *galapagoensis*, GOULD, Proc. Zool. Soc., Pt. v, 1837, p. 10 (Galapagos Islands; collection Zool. Soc.).

Otus galapagoensis, GOULD, in Zool. Voy. Beagle, III, Birds, 1841, p. 32, pl. III (James Island).—GRAY, Gen. Birds, I, 1844, p. 40.—SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Indefatigable Island).

Brachyotus galapagoensis, BONAPARTE, Consp. Av., I, 1850, p. 51.—CASSIN, Illustr. Birds Cal., Tex., etc., 1854, p. 183.—HARTLAUB, Jour. für. Orn., 1854, p. 170.

Asio galapagoensis, STRICKLAND, Orn. Syn., I, 1855, p. 211.—RIDGWAY, Proc. U. S. Nat. Mus., IV, 1881 (Apr. 6, 1882), p. 371 (synonymy), XII, 1889 (1890), pp. 120, 122, 123 (James and Indefatigable islands).

[*Brachyotus palustris.*] *c. galapagoensis*, COUES, Birds N.-W., 1874, p. 307.

Asio galapagensis, SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 493 (James and Indefatigable islands).

[*Asio accipitrinus.*] *γ. Asio galapagoensis*, SHARPE, Cat. Birds Brit. Mus., II, 1875, p. 238.

Asio accipitrinus (nec *Strix accipitrina*, PALLAS), SHARPE, Cat. Birds Brit. Mus., II, 1875, p. 234 (part).

Specific characters.—Similar to *A. accipitrinus* (Pallas), but smaller (wing 11–11.90); legs marked with narrow dusky bars, and under parts with a greater or less number of transverse dusky bars: dorsal region irregular barred or transversely spotted with fulvous; outer webs of primaries with the brown spaces more extensive than the fulvous ones on the basal portion.

Range.—Galapagos Archipelago: Albemarle Island (Baur and Adams); Hood Island (Baur and Adams); Indefatigable Island (Habel); James Island (Darwin); Tower Island (Baur and Adams); Bindloe Island (Baur and Adams).

"COLOUR.—Facial disc; plumose feathers immediately around the eyes, nearly black, tipped with glossy fulvous; those nearer the margin are white at their base, and only slightly tipped with a darker brown. Between the eyes a band of small fulvous feathers with a central streak of dark brown, passing backward, blends into the plumage of the nape. Back of head and throat streaked with fulvous and brown, the centre of each feather being brown, and its edges fulvous. Interscapular region and the feathers of the wing, coloured in the same manner, but the fulvous part is indented on each side of the shaft in the brown, giving an obscurely barred appearance to these feathers. Primaries brown, with large rounded marks of fulvous; those on the first feather being smaller, and almost white: wing-coverts brown, and but little mottled. Tail with transverse bars of the same brown and fulvous, the latter colour much clearer and stronger on the external feathers; in the central ones, the fulvous part includes irregular markings of the dark brown. *Under surface.*—Throat and breast, with center of each feather brown, edged with fulvous; the former colour being predominant. On the belly and under tail-coverts the brown coloured marks on the shafts are narrow, but they are united to narrow transverse bars, which form at the points of intersection marked something like arrow-heads. The fulvous tint is here predominant. Downy feathers on thighs same fulvous colour as rest of body. Bill black.

"FORM.—Second primary scarcely perceptibly longer than the first, and fourth rather longer than first. Tarsi thickly clothed with short feathers to the root of the nails.

	In.		In.
"Total length	13¼	Middle toe to root of nail	1 1/10
Wings	11	From tip of beak to interior edge of nostril	6/10
Tail	6		
Tarsi	2		

"Habitat, James Island, Galapagos Archipelago, (*October*).

"Mr. Gould informs me, that 'this species has most of the essential characters of the common short-eared owl of Europe (*Strix brachyota*), but differs from it, and all the other members of the group, in its smaller size and darker colouring.'

"The lesser proportional size of the fulvous marks on the first primaries, and on the tail, and the peculiar transverse brown marks on the feathers of the belly, easily distinguish it from the common short-eared owl. The specimen described is a male bird." (Darwin.)

This local form of the cosmopolitan *A. accipitrinus* is much smaller than the continental bird, and rather darker in color than the darkest specimens of the latter. The markings on the lower parts, especially on the sides, flanks, abdomen, and under tail-coverts, instead of being simply linear, are complicated by transverse bars which coalesce with the longitudinal stripes, producing something like a "herring bone" pattern, though some of the markings are distinctly hastate. A tendency to similar markings is very rarely seen in *A. accipitrinus*, but in *A. galapagoensis* they are exaggerated and constant.

Measurements of Asio galapagoensis.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Tarsus.	Middle toe.
218	B. & A.	Adult male	Hood, Galapagos	July 5, 1891	11.10	4.82	0.80	1.95	1.06
a	B. & A.	do	Tower, Galapagos	Sept. 3, 1891	11.00	5.38	.80	1.75	1.12
506	B. & A.	do	North Albemarle, Galapagos.	Aug. 11, 1891	11.90	5.38	.81	1.95	1.04
			Average		11.33	5.13	.80	1.88	1.07

Family BUTEONIDÆ.

Genus BUTEO, Cuvier.

Buteo, CUVIER, Leç. Anat. Comp., I, Pt. II, Ois., 1799–1800. Type, *Falco buteo*, Linnæus.

Range.—Cosmopolitan (except Australia, New Zealand, and parts of Polynesia). Galapagos Archipelago (one peculiar species, closely related to a widely dispersed continental American species).

BUTEO GALAPAGOENSIS (Gould).

Polyborus galapagoensis, GOULD, Proc. Zool. Soc., Pt. v, 1837, p. 9 (Galapagos Islands; collection Zool. Soc.).

Craxirex galapagoensis, GOULD, Zool. Voy. Beagle, III, Birds, 1841, p. 23, pl. II (James Island).—SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Indefatigable and Abingdon islands).

Buteo galapagoensis, RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, pp. 113, 120, 121, 122, 123, 124, 128 (Indefatigable, Chatham, and Abingdon islands).

Buteo galapagensis, SUNDEVALL, Proc. Zool. Soc., 1871, p. 125.—SCLATER and SALVIN, Nom. Av. Neotr., 1873, p. 119.—SHARPE, Cat. Birds Brit. Mus., I, 1874, p. 170.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 495 (Indefatigable and Abingdon islands).

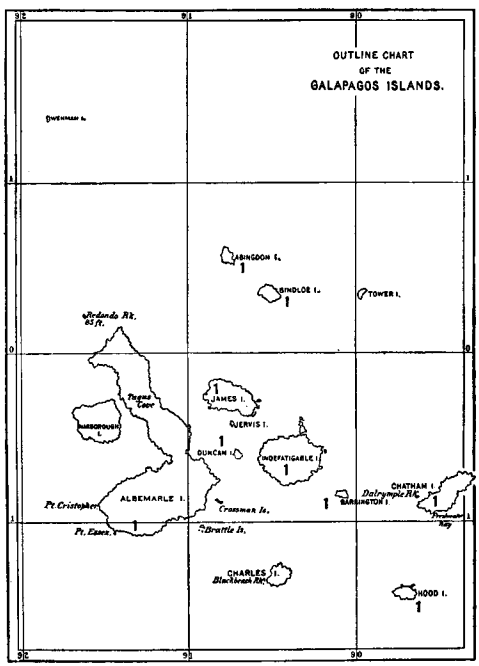
"*Buteo leucops*, GRAY, Cat. Accipite, 1848, p. 36" (Sharpe).

Pœcilopternis infulatus, KAUP, Contr. Orn., 1850, p. 76 (Galapagos Islands; collection Brit. Mus.;=juv.).

Specific characters.—Similar to *B. swainsoni*, Bonaparte, but larger, with proportionally larger bill and feet.

Range.—Galapagos Archipelago: South Albemarle Island(Baur and Adams); Duncan Island (Baur and Adams); Hood Island (Habel);[1] Chatham Island (Townsend, Baur and Adams); Barrington Island (Baur and Adams); Indefatigable Island (Darwin ?, Habel, *Albatross*, Baur and Adams); James Island (Darwin); Bindloe Island (Baur and Adams); Abingdon Island (Habel, *Albatross*).

ASCERTAINED RANGE OF THE GENUS BUTEO, CUVIER, IN THE GALAPAGOS ARCHIPELAGO.



1. *Buteo galapagoensis* (Gould).

Adult male (*dark phase*).—No. 116136, U.S.N.M.; Abingdon Island, April 16, 1888; C. H. Townsend. Nearly uniform dark sooty brown, inclining to brownish black on head, lighter and tinged with rusty on sides, flanks, abdomen, and tibiæ, where the feathers have more or less distinct terminal margins of lighter brown; under tail-coverts with

[1] Seen, but not collected.

broad white bars, mostly concealed, except on longer feathers, where the whitish bars nearly equal the dark brown interspaces in extent; secondaries darker brown than wing-coverts, crossed by four or five (exposed) broad obsolete bars of a still darker shade, and margined terminally with pale grayish brown; primaries brownish black, slightly grayer on outer webs, where traces of obsolete darker bars can be discovered on second to fourth quills; inner webs of primaries, on under surface, anterior to emarginations, grading from white on first quill to brownish gray on the innermost, all marked with broken bars and freckling of brownish gray; under wing-coverts plain dark sooty brown, the greater series rather paler and barred, especially on inner webs, with light grayish. Upper tail-coverts barred on outer webs with white and dark brown, their inner webs with light grayish brown and dark brown, the lighter and darker bars nearly equal in width. Tail grayish brown, with more or less of a hoary cast (especially on the newer feathers), crossed, beyond tips of upper coverts, by about nine bars of dusky, of which the last is broadest and succeeded by a narrow terminal band of whitish brown (dirty white on newer feathers). Bill grayish black, paler (light bluish in life?) basally; cere yellowish; legs and feet yellowish, claws grayish black.[1] Length (skin), 19.25; wing, 15.50; tail, 8; culmen, 1.07; tarsus, 3.03; middle toe, 1.70.

Adult female (*dark phase*).—No. 116058, U.S.N.M.; Indefatigable Island, April 12, 1888; C. H. Townsend. Similar to the adult male, as described above, but under parts (except under tail-coverts) quite uniform dark sooty brown; inner webs of primaries, anterior to emarginations, without bars, but thickly freckled with darker and lighter brownish gray. Length (skin), 21; wing, 16.10; tail, 8.55; culmen, 1.25; tarsus, 3.20; middle toe, 1.95.

Young female.—No. 131672, U.S.N.M.; Chatham Island, March 30, 1891; C. H. Townsend. General color of upper parts dark sooty brown, but this broken on head and neck by streaks of buff and on back, scapulars, wing-coverts, and rump by subbasal spots and edgings of the same; remiges as in adults; upper tail-coverts irregularly barred with sooty brown and ochraceous-buff; tail grayish brown, washed with hoary gray on middle feathers, crossed by numerous bars of dusky (narrower than in adult), which become obsolete toward the base of the tail, the last one much the broadest, and narrowly tipped with pale brown or dirty brownish white; the inner webs of the rectrices light pinkish buff, shaded with grayish brown and marked with irregular narrow dusky bars, rather more distinct than those on outer webs. Under parts deep ochraceous-buff, marked with shaft streaks and tear-shaped spots of dark sooty brown, largest on belly and flanks, the thighs, under tail-coverts, and under wing-coverts transversely spotted

[1] Mr. Adams, in his manuscript notes, describes the fresh colors of a female (age not stated) as follows: "Iris ochraceous-buff; cere naples yellow; feet and legs maize yellow."

with the same; under surface of primaries, anterior to their emarginations, pale buff, or buffy white, almost immaculate. Length (skin), 22; wing, 16.50; tail, 9; culmen, 1.19; tarsus, 2.90; middle toe, 1.95.

Another young female, from Indefatigable Island (No. 116059, U.S.N.M., April 12, 1888), is much darker than the one described, both above and below, the ochraceous-buff markings on the under parts being also paler.

This insular species is very closely related to *B. swainsoni*, Bonaparte, which it almost exactly resembles in coloration, but the bill and feet are very much stronger. Only dark-colored adults have hitherto been taken, and *B. galapagoensis* may possibly not have a light-colored phase of plumage as has *B. swainsoni*.

Measurements of Buteo galapagoensis (Gould).

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen, from cere.	Tarsus.	Middle toe.
116136	U.S.	Adult male	Abingdon Island.	Apr. 16, 1888	15.50	8.00	1.07	3.03	1.70
113	B. & A.	do	Chatham Island.	June 24, 1891	15.10	8.03	1.06	2.87	2.00
280	B. & A.	do	Barrington Island.	July 19, 1891	15.12	9.18	1.04	2.79	1.80
			Average		15.24	8.40	1.06	2.83	1.83
116058	U.S.	Adult female	Indefatigable Island.	Apr. 12, 1888	16.10	8.55	1.25	3.20	1.95
131672	U.S.	Juvenile female.	Chatham Island.	Mar. 30, 1891	16.50	9.00	1.19	2.90	1.95
87	B. & A.	Adult female	do	June 19, 1891	16.75	8.70	1.12	2.86	2.02
281	B. & A.	do	Barrington Island.	July 10, 1891	16.90	8.75	1.20	2.82	2.10
286	B. & A.	do	Indefatigable Island.	July 11, 1891	16.62	9.35	1.21	2.93	2.10
287	B. & A.	do	do	do	16.15	8.33	1.25	3.05	2.00
288	B. & A.	do	do	July 12, 1891	16.48	8.50	1.24	2.86	2.02
			Average		16.50	8.89	1.21	2.95	2.02

Family FREGATIDÆ.

Genus FREGATA, Cuvier.

Fregata, Brisson, Orn. VI, 1760, 506. Type, *Pelecanus aquilus*, Linnæus.

Range.—Tropical and subtropical seas of both hemispheres; Galapagos Archipelago.

FREGATA AQUILA (Linnæus).

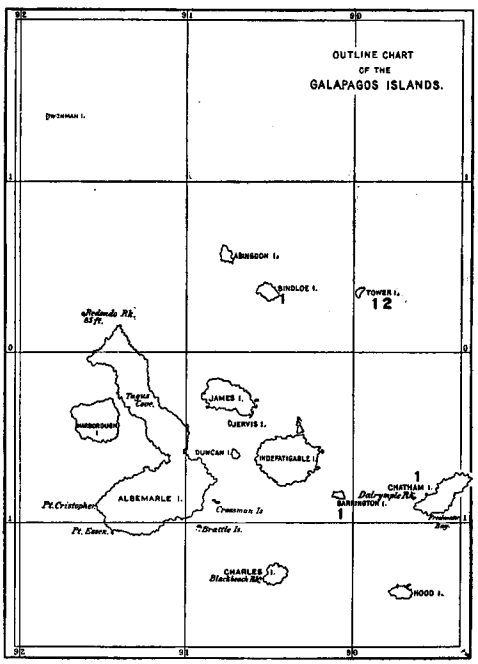
Pelecanus aquilus, Linnæus, Syst. Nat., 10th ed., I, 1758, p. 133.

Tachypetes aquilus, Vieillot, Gal. Ois., 1825, pl. 274.—Sundevall, Proc. Zool. Soc., 1871, p. 125 (Galapagos).

Fregata aquila, Gould, Zool. Beagle, III, Birds, 1841, p. 146 (Galapagos).—Salvin, Trans. Zool. Soc. Lond., IX, Pt. IX, 1876, p. 497 (Galapagos).—Baird, Brewer, and Ridgway, Water Birds N. Amer. II, 1884, p. 128.—Ridgway, Man. N. Amer. Birds, 1887, p. 83.

Range.—Intertropical and subtropical seas in general. Galapagos Archipelago: No special locality (Darwin, Kinberg); Chatham, Barrington, Tower, and Bindloe islands (Baur and Adams).

ASCERTAINED RANGE OF THE GENUS FREGATA, CUVIER, IN THE GALAPAGOS ARCHIPELAGO.



1. *Fregata aquila* (Linnæus).
2. *Fregata aquila minor* (Gmelin).

FREGATA AQUILA MINOR (Gmelin).

Pelecanus minor, GMELIN, Syst. Nat., I, 1788, p. 572.

Tachypetes minor, BONAPARTE, Consp. Av., II, 1855, p. 167 (part: excl. syn. *Attagen ariel*, Gould[1]).

Fregata minor, RIDGWAY, in Baird, Brewer and Ridgway's Water Birds N. Amer., II, 1884, p. 128; Manual N. Amer. Birds, 1887, p. 83.

Range.—Central Pacific and Indian oceans. Accidental (?) in the Galapagos Archipelago: Tower Island (Baur and Adams).

[1] A totally distinct species, easily recognized by the white flank-patch of the adult male and other perfectly obvious characters. (See p. 592.)

One specimen of this smaller form, an adult male, was obtained at Tower Island, September 3, 1891, by Messrs. Baur and Adams.

Besides being considerably smaller, this bird differs from the three examples of true *F. aquila* in coloration, the plumage being much more glossy, and the metallic coloring of the back and scapulars brilliant green mixed with a little purple, instead of just the reverse. The lesser wing-coverts also have a large area of dull brownish feathers, running parallel with the anterior border of the wing, there being no trace of such coloration in the three specimens of *F. aquila*.

The measurements of this specimen are herewith given, as well as those of three adult males of true *F. aquila* from the Galapagos and an equal number (the smallest of six) from the Bahamas.

Measurements of Fregata aquila minor.

Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Middle toe.
Adult male..	Tower Island, Galapagos	Sept. 3, 1891	22.80	14.60	3.82	2.06

Measurements of Fregata aquila from the Galapagos.

Adult male..	Tower Island, Galapagos	Sept. 3, 1891	25.70	18.75	4.38	2.18
Do.....	Barrington Island, Galapagos.....	July 8, 1891	25.51	18.80	4.38	2.15
Do.....	.....do	.....do	24.30	18.00	4.05	2.05
	Average	.....	25.17	18.52	4.27	2.13

Measurements of Fregata aquila from the Bahamas.

Adult male..	Key Verd, Bahamas	Feb. 3, 1892	23.75	18.00	4.20	.....
Do.....	.....do	.....do	24.10	17.75	4.30	2.10
Do.....	.....do	.....do	24.45	18.75	4.12	2.05
	Average	.....	24.10	18.17	4.21	2.07

Whether or not *F. aquila minor* be worthy of recognition as a separate form from true *F. aquila*, there can be no question as to the fact that it was upon this form that Gmelin's name *Pelecanus minor* was based. It is equally certain that the name *Attagen ariel*, Gould, so generally quoted as a synonym of *F. minor*, does not at all belong to the latter bird, but to a very distinct species inhabiting the seas between Africa and Australia (and doubtless elsewhere). *F. ariel* is still smaller than *F. a. minor*, very much more slender, and differs further in several very conspicuous color-characters, among which may be mentioned a large white flank-patch, of which there is no trace in either *F. aquila* or its smaller form.

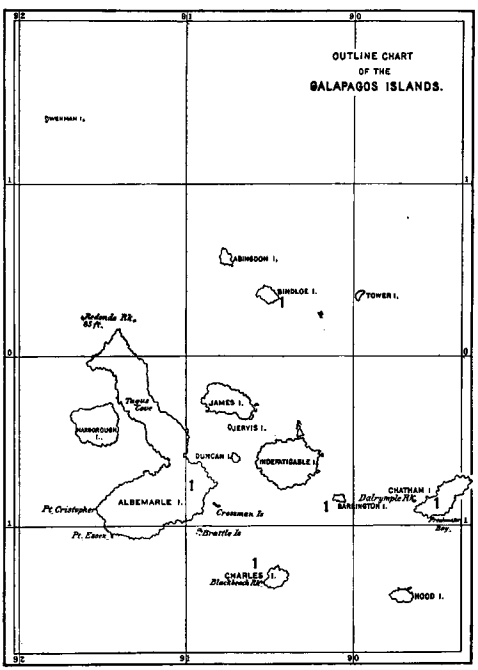
Family PELECANIDÆ.

Genus PELECANUS, Linnæus.

Pelecanus, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 132. Type, by elimination, *P. onocrotalus*, Linnæus.

Range.—Nearly cosmopolitan (wanting in New Zealand and Polynesia). Galapagos Archipelago (one species, found also on Pacific coast of America).

ASCERTAINED RANGE OF THE GENUS PELECANUS, LINNÆUS, IN THE GALAPAGOS ARCHIPELAGO.



1. *Pelecanus fuscus californicus*, Ridgway.

PELECANUS FUSCUS CALIFORNICUS, Ridgway.

Pelecanus fuscus (nec LINNÆUS), SUNDEVALL, Proc. Zool. Soc., 1871, p. 125 (Galapagos Islands).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 496 (Galapagos Islands); Proc. Zool. Soc., 1883, p. 427 (Charles Island; Payta, Peru).

Pelecanus fuscus (?) *californicus*, RIDGWAY, in Baird, Brewer and Ridgway's Water Birds N. Amer., II, August, 1884, p. 143 (La Paz, Lower California; collection, U. S. Nat. Mus.).

Pelecanus californicus, RIDGWAY, in Baird, Brewer & Ridgway's Water Birds N. Amer., II, 1884, p. 143 (in text); Man. N. Amer. Birds, 1887, p. 82; Proc. U. S. Nat. Mus., XII, 1889 (1890), p. 113 (Chatham Island).—AMERICAN ORNITHOLOGISTS' UNION, Check List, 1886, No. 127.

Range.—Pacific coast of America, from Washington to coast of Peru (Payta, Markham). Galapagos Archipelago: No locality, (Kinberg); Albemarle, Barrington, and Bindloe islands (Baur and Adams); Charles Island (Markham, Baur and Adams); Chatham Island (Townsend, Baur and Adams).

The single adult example (No. 115964, U.S.N.M.) collected by Mr. Townsend is in the white-necked or post-nuptial plumage, and agrees exactly with Californian specimens, except that the lower parts are darker and more distinctly streaked with white, each feather having a very distinct though narrow mesial streak of this color. The pouch, in the dried skin, is light brown basally, and the bill is chiefly orange-reddish, the sides of the mandible with only a slight blackish mottling toward the base.

No. 115965 is apparently a female, and is in transition immature plumage, the brownish chestnut of the neck being interspersed with white feathers.

The third of Mr. Townsend's specimens (No. 116297) is a young bird, probably a male, of the preceding year, and agrees exactly with a specimen from California. In this the sides of the mandible are mainly blackish, becoming orange-reddish terminally and whitish basally; the pouch light brownish basally, as in the preceding.

Dr. Baur's specimens appear to be quite identical with California examples, except that all show distinct though very narrow white shaft-streaks on the lower parts, and none of them have the pouch at all reddish. Mr. Adams's fresh color-notes are as follows:

Nail of beak straw yellow, basal portion brownish black; side of mandibles near ends orange-vermilion; pouch slate-black, with just a tinge of purplish at angle of jaws and greenish in median portion; bare skin around eyes more purplish.

Measurements of Galapagoan specimens of Pelecanus fuscus californicus.

Number.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Tarsus.	Middle toe.
115964	Adult male	Chatham Island	Apr. 5, 1888	22.75	7.80	14.00	3.30	4.50
115965	Adult female?	do	do	21.25	6.00	12.25	3.15	4.05
116297	Immature male?			22.00	6.25	14.00	3.35	4.25
302	Adult male	Albemarle Island	July 14, 1891	23.15	5.25	14.46	3.03	4.53
379	do	do	July 24, 1891	22.40	5.18	14.12	2.93	4.47
380	Adult female	do	do	21.13	5.51	12.20	2.75	4.15
	do	(?)	(?)	22.48	5.87	15.37	3.03	4.42
		Average		22.16	5.99	13.77	3.08	4.34

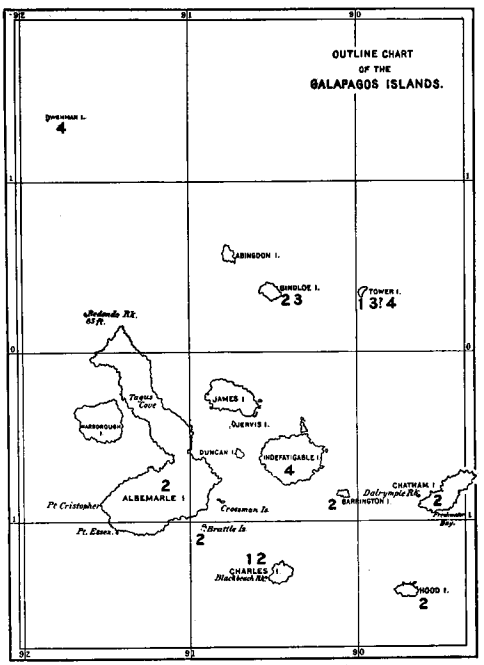
Family SULIDÆ.

Genus SULA, Brisson.

Sula, BRISSON, Orn., VI, 1760, p. 495. Type, by elimination, *Pelecanus sula*, Linnæus.

Range.—Nearly cosmopolitan, on seacoasts and islands (wanting in colder regions). Galapagos Archipelago (two American species and two of wide distribution).

ASCERTAINED RANGE OF THE GENUS SULA, BRISSON, IN THE GALAPAGOS ARCHIPELAGO.



1. *Sula cyanops*, Sundevall. ("Galapagos.")
2. *Sula nebouxii*, Milne-Edwards.
3. *Sula brewsteri*, Goss. ("Galapagos;" also, Cowley Island.)
4. *Sula piscator* (Linnæus).

SULA CYANOPS, Sundevall.

Dysporus cyanops, SUNDEVALL, Phys. Tidskr. Lund., 1837, Pt. v; Proc. Zool. Soc., 1871, p. 125 (Galapagos Islands).

Sula cyanops, SUNDEVALL, Isis, 1842, p. 858.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 496 (Galapagos, fide SUNDEVALL); Proc. Zool. Soc., 1883, p. 427 (Charles Island).—BAIRD, BREWER and RIDGWAY, Water Birds N. Amer., II, 1884, p. 176.—RIDGWAY, Man. N. Amer. Birds, 1887, p. 75.

Range.—Intertropical seas in general. ?Galapagos Archipelago: No locality (Kinberg); Charles Island (Markham); Tower Island (Baur and Adams).

I follow Mr. Salvin in giving this species on the authority of Professor Sundevall,[1] who includes it in his paper "On birds from the Galapagos Islands." Mr. Townsend did not meet with it, but Dr. Baur mentions it in his list of birds observed at Tower Island. The specimens, if any were collected, must have been with those lost or stolen at Guayaquil, none being in the collection received at the National Museum.

SULA NEBOUXII, Milne-Edwards.

Sula nebouxii, MILNE-EDWARDS, Ann. Soc. Nat. Zool., 52, Ann. VI, ser. T, XIII, Nos. 2-4, art. 4, p. 37, pl. XIV (Chile).

Sula gossi, RIDGWAY, Auk, V, July, 1888, p. 241 (San Pedro Martir Island, Gulf of California; collection U. S. Nat. Mus.); Proc. U. S. Nat Mus., XII, 1889 (1890), pp. 114, 120, 121 (Chatham Island, Galapagos).—AMERICAN ORNITHOLOGISTS' UNION, Check List, abridged ed., 1889, No 114.1.

Specific characters.—Adult. Head, neck, and entire lower parts white, the first two streaked with sooty grayish; back and scapulars dusky brownish, the feathers tipped with whitish; legs and feet bright blue in life. Length (before skinning), about 32–34.50; wing, 15.50–17.50; tail, 8–10; culmen, 3.98–4.55; tarsus, 1.85–2.30; middle toe, 2.65–3.05.

Range.—Pacific Coast of America, from the Gulf of California, the Revillegigedo Islands, etc., to the coast of Chile. Galapagos Archipelago: Albemarle, Brattle, Charles, Barrington, and Bindloe islands (Baur and Adams); Hood Island (Habel);[2] Chatham Island (Townsend, Baur and Adams).

Adult male.—Feathers of head and neck grayish white, widely edged in middle portion with dark sooty grayish, their lanceolate tips pure white, producing a wavy streaked appearance; these markings become obsolete on the anterior part of the forehead, and on the throat for some distance behind the gular sac, and are nearly uniform grayish white; lower neck and entire lower parts, including flanks, axillaries, and most of the under wing-coverts, pure white, broken only on the sides of the lower neck by rather indistinct broad streaks of pale sooty grayish, changing posteriorly next to back into more distinct spots of a deeper hue; feathers of back and scapulars deep sooty grayish or grayish brown, rather broadly but not abruptly tipped with dull white, these terminal spots larger and more distinct on posterior scapulars; wing-coverts entirely plain grayish brown or light sepia, deepening gradually into sooty slate on primaries; lower back and lower rump pale grayish sepia, fading gradually into white on upper tail-coverts; the upper parts of rump chiefly pure white; middle tail feathers white, faintly shaded on outer portion of outer web for about the terminal third with pale brownish gray, their shafts entirely clear yellowish

[1] Proc. Zool. Soc. Lond., 1871, pp. 124-130. [2] Not collected.

white, the outer pair wholly sooty grayish (darker terminally and on most of outer web), the others gradually paler toward the middle pair. Iris yellow; bill dull olive-blue; bare space around bill, eyes, lores, and gular sac slate-blue; legs, feet, and webs bright clear ultramarine blue with a slight greenish tint on webs; claws pale glaucous-blue.

Adult female.—Essentially like the male, but averaging slightly larger; iris paler yellow; plumage rather darker, except hind neck, which is less distinctly streaked.

So far as I am able to see, Galapagoan specimens are quite identical with those from the Gulf of California. Following are Mr. Adams' notes on the fresh colors of the bill, etc.:

Feet and legs . . a purplish blue, lighter than royal purple [Ridgway's Nomenclature of Colors]; tarsus and toes possess the more blue, while the webs have more of the darker purplish, especially toward their edges. Bare skin of head and throat much duller purple, very near plumbeous.

SULA BREWSTERI, Goss.

Dysporus leucogaster (nec *Pelecanus leucogaster*, BODDAERT), SUNDEVALL, Proc. Zool. Soc., 1871, p. 125 (Galapagos Islands).

Sula leucogastra, SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 496 (Galapagos, fide Sundevall).

Sula brewsteri, Goss, Auk, V, July, 1888, p. 242 (San Pedro Martir Island, Gulf of California; collection U. S. Nat. Mus.).—AMERICAN ORNITHOLOGISTS' UNION, Check List, abridged ed., 1889, No. 115.1.

Specific characters.—Similar to *S. leucogaster* (Boddaert), but back uniform in color with the neck, the head and neck paler than in that species, especially the adult male, in which the former gradually fades into white anteriorly; unfeathered parts quite differently colored from *S. leucogaster*. Length, 29.50–31.50; extent of wings, 55.50–59.50; wing, 14–16.50; tail, 7–9; culmen to frontal feathers, 3.47–4; tarsus, 1.80–2.05; middle toe, 2.30–2.85.

Range.—Pacific coast of America and adjacent islands, from Lower California to the Galapagos Archipelago: No locality (Kinberg); Tower Island (Habel)?;[1] Bindloe and Cowley islands (Baur and Adams).

Adult male.—Type, No. 113436, U.S.N.M.; San Pedro Martir Isle, Gulf of California, March 21, 1888; N. S. Goss. Neck pale drab-gray, fading gradually into white on anterior portion of head, all round, and deepening into smoky drab on chest; entire upper parts (except head and neck) entirely uniform rich drab-brown or sepia, deepening on primaries and rectrices into rich purplish brown or seal brown, the shafts of these feathers black. Entire lower parts posterior to chest,

[1] "On Tower Island also a small species [of gannet] is found with chocolate-colored plumage. Of this species a specimen was caught on board the sloop and secured by tying it by one leg. But on Bindloe it was liberated by somebody." (Trans. Zool. Soc. Lond., IX, Pt. IX, 1876, p. 460.)

While this may possibly have been the gray phase of *S. piscator*, the latter could not properly be described, in any stage, as "chocolate-colored;" this term does, however, fit *S. brewsteri* very well.

including axillars and oblique bar across middle of under wing-covert region, plain pure white. "Bill olive-blue; lores and bare space around eyes indigo blue; gular sac dull slate-blue, with a greenish tint; legs, feet, and webs light pea green." (Goss, MS.). Length (before skinning), 31.50; wing, 15.50; tail, 9, graduated for 3.50; culmen, to frontal feathers, 3,80; depth of bill at base, 1.30, at narrowest part behind ungui, 0.55; tarsus, 1,90, middle toe, 2.75.

Adult female.—No. 113437, U.S.N.M.; same locality and collector, March 24, 1888. Decidedly larger than the male, but similar in plumage except that the head, neck, and chest are much darker, being exactly like the upper surface of the body, etc., though perceptibly paler (a medium shade of grayish drab) on anterior portion of head. "Bill pale bluish horn, fading after death, and toward base, into a dull dirty buff; lores, slate-blue; bare space around eyes, and gular sac pale yellowish green; legs, feet, and webs lighter in color [than gular sac], and with more of a yellow look." (Goss, MS.). Length (before skinning), 31.50; wing, 15.50; tail, 9, graduated for 3.50; culmen, to frontal feathers, 3.80; depth of bill at base, 1.30, at narrowest part behind ungui, 0.55; tarsus, 1.90; middle toe, 2.75.

The iris is said to be "dark brown with a narrow ring of grayish white around outer edge" and the claws "glaucous-blue" in both sexes. (Goss.)

Although I have not seen a specimen of the dark-colored *Sula* found in the Galapagos, I have no doubt the species mentioned by Sundevall and Salvin under the name *leucogaster* is in reality *S. brewsteri*, which is the Pacific coast representative of *S. leucogaster*, the latter being apparently confined to the Atlantic side of the continent.

SULA PISCATOR (Linnæus).

Pelecanus piscator, LINNÆUS. Syst. Nat., 10th ed., I, 1758, p. 134.

Sula piscator, BONAPARTE, Consp. Av., II, 1857, p. 166.—BAIRD, BREWER and RIDGWAY, Water Birds N. Amer., II, 1884, p. 182.—RIDGWAY, Man. N. Amer. Birds, 1887, p. 76.

Range.—Intertropical seas in general, north, in America, to Florida and Lower California; Galapagos Archipelago: Indefatigable and Tower islands (Baur and Adams); Wenman Island (Townsend).

The five specimens in Dr. Baur's collection, and Mr. Townsend's Wenman Island bird, although unquestionably adults, with deep red feet and other evidences of full maturity, are all in the gray plumage. All have gray tails, and only one, a male from Tower Island, has any portion of the plumage inclining to white, the lower parts posterior to the breast being soiled white (purer beneath the surface) and the posterior scapulars and longer upper tail-coverts whitish.

Mr. Adams' fresh color-notes on these specimens are as follows:

Legs and feet a trifle more red and purple than madder brown; beak with just a little more blue than lavender-gray; bare skin across forehead and on sides of mandible next to horny portion same as legs, but paler; around eye a little more blue than beak; angle of jaw next feathers and on throat between rami dark purplish.

Measurements of specimens of Sula piscator from the Galapagos.

Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Depth of bill at base	Width of bill at base.	Tarsus.	Middle toe.
Adult female	Wenman Island	Apr. 4, ——	15.75	8.10	3.38	1.10	0.90	1.45	2.45
Do	Indefatigable Island.	Sept. 3, 1891	15.50	8.24	3.25	1.05	.85	1.53	2.62
Do	do	do	15.60	7.92	3.26	1.21	.91	1.41	2.56
Adult male	do	Sept. 4, 1891	15.35	8.02	3.20	1.10	.92	1.27	2.43
Adult female	Tower Island		15.35	7.83	3.00	1.11	.87	1.33	2.42
Adult male	do	Aug. 3, 1891	15.15	8.90	3.25	1.14	.85	1.28	2.38
	Average		15.45	8.17	3.22	1.12	.87	1.38	2.44

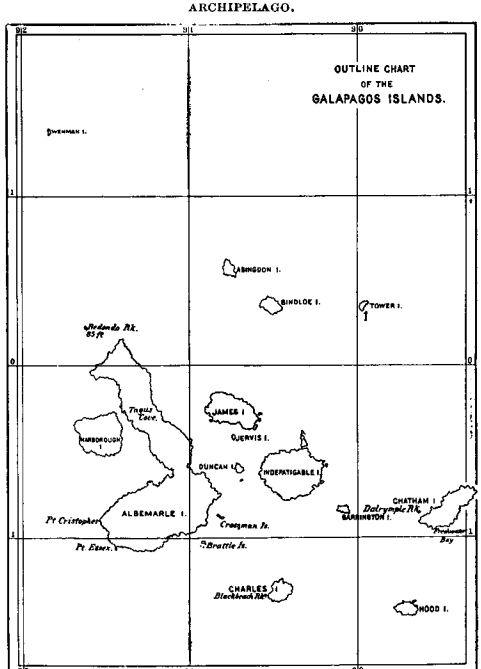
Family PHAËTHONTIDÆ.

Genus PHAËTHON, Linnæus.

Phaëthon, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 134. Type, *P. æthereus*, LINNÆUS.

Range.—Intertropical seas in general. Galapagos Archipelago (one species of wide distribution).

ASCERTAINED RANGE OF THE GENUS PHAËTHON, LINNÆUS, IN THE GALAPAGOS ARCHIPELAGO.



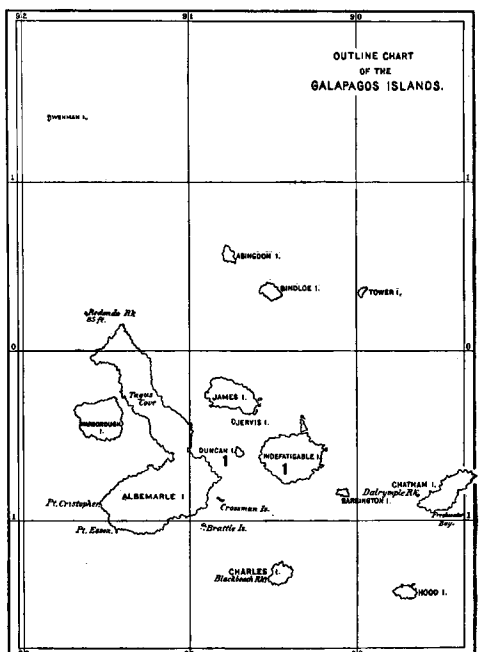
1. *Phaëthon æthereus*, Linnæus.

PHAËTHON ÆTHEREUS, Linnæus.

Phaëthon æthereus, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 134.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 497 (Tower Island, Galapagos Archipelago).—BAIRD, BREWER and RIDGWAY, Water Birds N. Amer., II, 1884, p. 189.—RIDGWAY, Man. N. Amer. Birds, 1887, p. 74.

Range.—Intertropical seas in general, north, in America, to the Bahamas and Lower California (accidentally to Newfoundland). Galapagos Archipelago: Tower Island (Habel, Baur and Adams).

ASCERTAINED RANGE OF THE GENUS ARDEA, LINNÆUS, IN THE GALAPAGOS ARCHIPELAGO.



1. *Ardea herodias*, Linnæus?

No specimens of this species were contained in the collection made by Mr. Townsend nor in that by Messrs. Baur and Adams, though the latter found it breeding on Tower Island. The following fresh color-notes are transcribed from Mr. Adams' note book:

Beak a *trifle* brown (madder brown) added to crimson; light part of tarsus and foot cream-buff, with middle of larger scales on foot ocher yellow.

Family ARDEIDÆ.

Genus ARDEA, Linnæus.

Ardea, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 141. Type, by elimination, *A. cinerea*, Linnæus.

Range.—Nearly cosmopolitan (wanting in New Zealand, Polynesia, etc.). Galapagos Archipelago (one species, doubtfully identified with a species of North, Middle, and northern South America).

?ARDEA HERODIAS, Linnæus.

Ardea herodias, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 143.—DARWIN, Zool. Voy. Beagle, III, Birds, 1841, p. 128 (Galapagos Archipelago).—SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Indefatigable Island).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 497 (Indefatigable Island).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 114 (Duncan Island).—BAIRD, BREWER and RIDGWAY, Water Birds N. Amer., I, 1884, p. 13.—RIDGWAY, Man. N. Amer. Birds, 1887, p. 129.

Range.—Temperate North America, whole of Middle America, and parts of northern South America. Galapagos Archipelago: Duncan Island (*Albatross*); Indefatigable Island (Habel).

I am not fully satisfied of the identity of the Galapagos bird with the true *A. herodias*, the single specimen examined (Mr. Townsend's Duncan Island example) being a young bird.

Genus HERODIAS, Boie.

Herodias, BOIE, Isis, 1822, p. 559. Type, by elimination, *Ardea egretta*, Gmelin.

Range.—Warmer parts of both hemispheres. ?Galapagos Archipelago (one species, undetermined, but supposed to be of this genus, and doubtfully identified with a widely distributed American species. No specimens).

?HERODIAS EGRETTA (Gmelin).

Ardea egretta, GMELIN, Syst. Nat., I, Pt. II, 1788, p. 629.—RIDGWAY, Man. N. Amer. Birds, 1887.

Herodias egretta, BAIRD, Birds N. Am. 1858, p. 666.—BAIRD, BREWER and RIDGWAY, Water Birds N. Amer., I, 1884, p. 23.

Range.—Temperate and tropical America in general. ?Galapagos Islands: Albemarle Island (Baur and Adams).

Although we have it on Dr. Baur's authority that a large white heron breeds in the Galapagos, the species is doubtful, and the bird found there may possibly be a white phase of the large gray heron of those islands, provisionally identified as *A. herodias*, Linnæus.[1] Under date of April 6, 1892, Dr. Baur writes me concerning this bird as follows:

On Albemarle I observed a rookery of a white heron (the adults fully white). I only secured a young bird in form of a skeleton. The gray heron (*Ardea herodias?*)

[1] Only immature specimens of which have been examined.

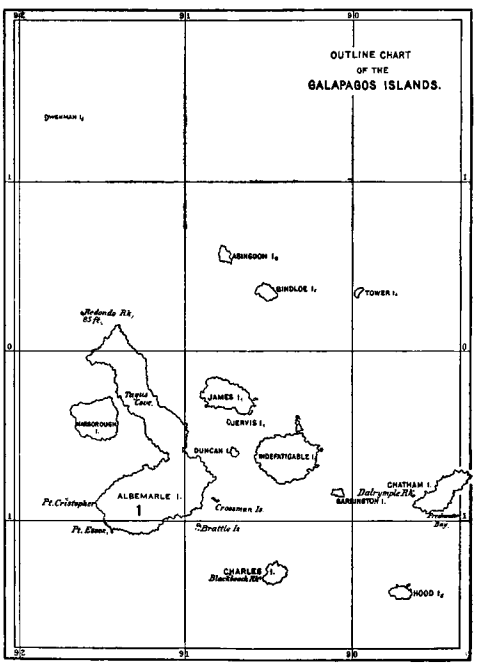
was also common there. The white heron was as large as, perhaps larger than, the *A. herodias*.

Genus BUTORIDES, Blyth.

Butorides, "BLYTH, 1849," BONAPARTE, Consp. Av., II, 1855, p. 128. Type, *Ardea javanica*, Horsfield.

Range.—Temperate and tropical portions of both hemispheres, but wanting in Europe, the greater part of Africa, New Zealand, etc. Galapagos Archipelago (one peculiar and strongly marked species).

ASCERTAINED RANGE OF THE GENUS HERODIAS, BOIE, IN THE GALAPAGOS ARCHIPELAGO.



1. *Herodias egretta* (Gmelin)†

BUTORIDES PLUMBEUS (Sundevall).

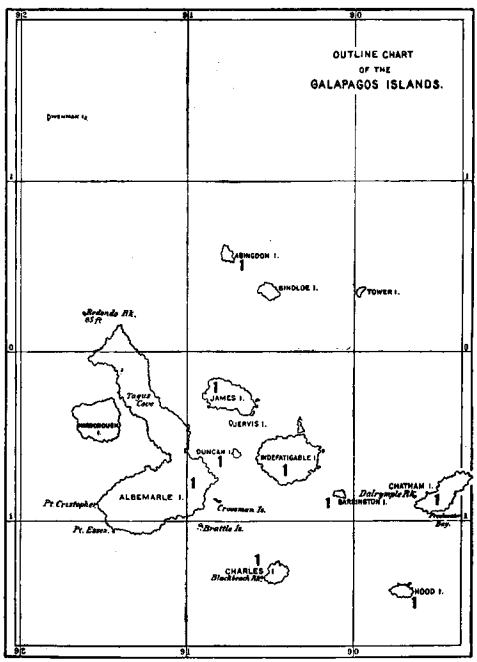
Butorides javanicus (nec *Ardea javanica*, HORSFIELD), SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Indefatigable Island, Galapagos Archipelago).

Ardea plumbea, SUNDEVALL, Proc. Zool. Soc., 1871, pp. 125, 127 (James Island, Galapagos Archipelago).

Butorides plumbeus, SCLATER and SALVIN, Nom. Av. Neotr., 1873, p. 125.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 497 (Indefatigable and James islands); Proc. Zool. Soc., 1883, p. 428 (Charles Island).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, pp. 114, 120, 121, 122, 123, 124 (Chatham, Indefatigable, James, Abingdon, Duncan, and Hood islands).

Ardea sundevalli, REICHENOW, Journ. für Orn., July, 1877, p. 253 (Galapagos Islands).

ASCERTAINED RANGE OF THE GENUS BUTORIDES, BLYTH, IN THE GALAPAGOS ARCHIPELAGO.



1. *Butorides plumbeus* (Sundevall).

Specific characters.—Of much stouter build and darker coloration than any other American species of the genus, the adult with little if any brown or chestnut in the plumage, which is plain gray (of varying shade) beneath, darker, glossed with green, above; young striped with whitish on a dusky ground beneath the dusky upper parts and neck, varied with rusty. Wing, 6.98–7.50; culmen, 2.05–2.80; depth of bill at base, 0.53–0.60; tarsus, 1.72–2.15; middle toe, 1.65–2.06.

Range.—Galapagos Archipelago: Albemarle Island (Baur and

Adams); Duncan Island (*Albatross*); Charles Island (Baur and Adams); Hood Island (*Albatross*, Baur and Adams); Chatham Island (Jones); Barrington Island (Baur and Adams); Indefatigable Island (Habel); James Island (Kinberg, *Albatross*, Baur and Adams); Abingdon Island (*Albatross*).

Adult male.—No. 116029, U.S.N.M.; James Island, April 11, 1888; C. H. Townsend. Entire pileum, including occipital crest, sooty black, strongly glossed, except on forehead, with dark metallic green; sides of head, including malar region, slate-black, the feathers slate-gray beneath the surface; neck uniform slate color, slightly darker posteriorly and lighter (slate-gray) anteriorly, the median line of the neck, as well as of the chin and throat, mainly white, marked with broad wedge-shaped streaks of slate-black—the median portion of the lower neck tinged with light drab-brown. Lanceolate dorsal and scapular plumes plumbeous-gray, faintly glossed with bronze-green, their shafts grayish white; wing-coverts dark slaty, strongly glossed with dark semimetallic green, some of the middle coverts narrowly edged on outer webs with light buff; secondaries similar, but rather less strongly glossed with green; primaries slate color, with a very faint greenish gloss and a decided "chalky" cast in some lights, their shafts glossy black. Tail dark greenish slate, strongly glossed with bronze-green. Under parts uniform deep slate-gray, rather darker anteriorly; edge of wing white. Bill wholly black; bare loral region blackish; legs and feet orange-brown (orange or salmon color in life?). Length (skin), 15.40; wing, 7.07; tail, 2.50; culmen, 2.50; depth of bill through nostrils, 0.55; tarsus, 2.02; middle toe, 1.73.

Adult female.—No. 116030, U.S.N.M.; same locality, etc. Similar to the adult male, but darker; the pileum and occipital crest less strongly glossed with green, the dorsal and scapular plumes rather less developed and much less glaucous, the sides of the head sooty black, the neck also nearly black, with only traces of white along the median line of the anterior portion, and the under parts dark sooty slate. Lower edge of mandible light brownish, and bare skin of lores and orbits largely light colored (yellowish or orange in life?); legs and feet mainly dusky brown. Length (skin), about 16.25; wing, 7.20; tail, 2.60; culmen, 2.64; depth of bill at nostrils, 0.55; tarsus, 2.13; middle toe, 1.90.

Young male.—No. 116190, U.S.N.M.; Hood Island, April 7, 1888; C. H. Townsend. Pileum and occipital crest sooty black, the feathers with rusty shaft-streaks, broadest on forehead, obsolete on occipital crest, which has a very faint bronzy gloss; neck and sides of head rusty cinnamon-rufous, broadly streaked with dull black; chin, throat, and median line of fore neck (broadly) white heavily streaked or dashed with black, the lengthened feathers of the lower fore neck dark brownish gray with a broad median streak or stripe of white. Back, scapulars, rump, and upper tail-coverts uniform deep sooty brown, the feathers

broad and rounded at ends, not pointed and elongated as in adults; wing-coverts dusky grayish brown, broadly margined and spotted with cinnamon-rufous; remiges as in the adult, but primaries marked with a small terminal triangular spot of white, except on three or four outermost quills. Under parts deep grayish sooty, striped with buff. Bill black, with lower portion of mandible light brownish; naked loral region dusky, with a light-colored broad stripe along upper edge; legs and feet brownish black, the soles of the latter light brown.[1]

There are very decided differences in the coloration of specimens from the different islands, but without a larger series I am unable to determine the significance or value of these variations. Thus, two adults collected by Dr. William H. Jones, U. S. N., one (No. 101322, U.S.N.M.) on Chatham Island, August 19, 1884, the other (No. 101327, U.S.N.M., adult male) without known locality, but probably from the same island, are decidedly lighter in color than those from James Island (the type locality of *B. plumbeus*). They have the wing-coverts distinctly margined with light tawny; the general color of the fore neck distinctly brown (light Prout's brown) instead of slate-gray, and both have a distinct yellowish or light greenish stripe along the lower edge of the mandible. Their measurements are given in the subjoined table.

An adult male from Hood Island (No. 116088, U.S.N.M, April 7, 1888; C. H. Townsend) is most like the James Island specimen, but has scarcely a trace of brown on the lower fore neck, and has neither white nor black markings along the median line of the fore neck, throat, and chin, which is light gray interrupted occasionally by the general blackish slate color of the neck.

An adult male from Abingdon Island (No. 116137, U.S.N.M., April 16, 1888; C. H. Townsend) has the whole front part of the neck very light gray, the upper fore neck and the throat with a few dusky flecks.

Possibly these differences are merely individual variations, but a comparison of several specimens from each island is much to be desired.

[1] The fresh colors of the unfeathered parts in a young female obtained by Mr. Adams (locality not stated) were as follows:

"Legs yellowish green with some of the large plates on front of the tarsus almost as dark as burnt umber and the scales on the upper surface of the toes same color; back of tarsus, heel, and soles of feet yellow; eyelids and lores yellow with a tinge of purplish over and beneath the eyes; under part of mandible same greenish yellow as legs; iris crimson. Total length, 21.50." (Adams, MS.)

Measurements of Butorides plumbeus.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Depth of bill at base.	Tarsus.	Middle toe.
101322	U. S.	Adult[1]	Chatham Island ..	Aug. 19, 1884	7.50	2.60	2.52	0.57	1.95	1.85
101327	U. S.	Adult male	.....do (?).....	(?)	7.00	2.50	2.55	.58	2.10	1.85
116029	U. S.	.....do	James Island.....	Apr. 11, 1888	7.07	2.50	2.50	.57	2.02	1.73
116030	U. S.	Adult female .	.....do	.....do	7.20	2.60	2.64	.59	2.13	1.90
583	B. & A.	.....do	.....do	Aug. 18, 1891	6.98	2.28	2.55	.57	1 85	1.76
116088	U. S.	Adult male ...	Hood Island.....	Apr. 7, 1888	7.48	2.65	2.80	.59	2 15	1.90
116089	U. S.	Adult female .	.....do	.... do	7.20	2.58	2.58	.53	2 00	1.87
209	B. & A.	Adult male ...	.....do	July 5, 1891	7.15	2.40	2.77	.60	1 72	1.95
116137	U. S.	.....do.[2]	Abingdon Island .	Apr. 16, 1888	7.45	2.60	2.60	.60	2.00	1.88
178	B. & A.	Adult female .	Charles Island....	July 1, 1891	7.00	2.35	2.65	.60	1.93	1.66
226	B. & A.	Adult male ...	Gardner Island...	July 6, 1891	7.45	2.05	2.45	.59	2.10	2.06
269	B. & A.	.....do	Barrington Island	July 9. 1891	7.00	2.30	2.47	.59	1.73	1.65
396	B. & A.	.....do	Albemarle Island.	July 14, 1891	7.00	2.25	2.65	.59	1.78	1.65
			Average....	.....	7.18	2.43	2.59	.58	1.95	1.74

[1] "Upper mandible black, lower whitish; feet slate color." (Dr. William H. Jones, U. S. N., MS.)
[2] "Breeding. Feet and legs reddish." (C. H. Townsend, MS.)

Genus NYCTANASSA, Stejneger.

Nycherodius, REICHENBACH, Syst. Av., 1852, p. xvi (nec *Nycterodius*, MACGILLIVRAY, 1842). Type, *Ardea violacea*, Linnæus.

Nyctanassa, STEJNEGER, Proc. U. S. Nat. Mus., X, Aug. 3, 1887, p. 295. Same type.

Range.—Warmer parts of America. Galapagos Archipelago (the common continental and only known species).

NYCTANASSA VIOLACEA (Linnæus).

Ardea violacea, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 143.

Nycticorax violaceus, GOULD, Zool. Voy. Beagle, III, Birds, 1841, p. 128 (Galapagos Archipelago).

Ardea violacea, L. (var. ?), SUNDEVALL, Proc. Zool. Soc., 1871, pp. 125, 128 (Galapagos).

Nyctanassa violacea, STEJNEGER, Proc. U. S. Nat. Mus., X, Aug. 3, 1887, p. 295, footnote.

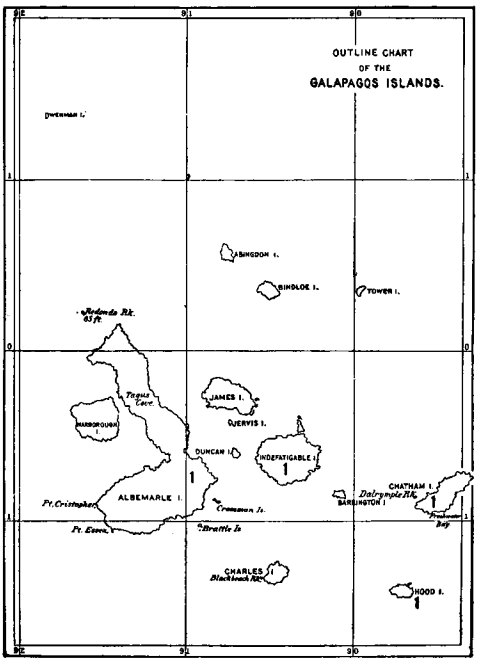
Nycticorax pauper, SCLATER and SALVIN, Proc. Zool. Soc., 1870, pp. 323, 327 (Indefatigable Island, Galapagos Archipelago).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 498 (Indefatigable Island).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 114 (Hood and Indefatigable islands).

Range.—Warm-temperate North America, east of Rocky Mountains, whole of Middle America, and warmer parts of South America. Galapagos Archipelago: Albemarle Island (Baur and Adams); Hood Island (*Albatross*, Baur and Adams); Chatham Island (Baur and Adams); Indefatigable Island (Habel).

Adult specimens of the Yellow-crowned Night Heron from the Galapagos Islands are quite indistinguishable from North American examples, the *Nycticorax pauper* of Sclater and Salvin having been based on immature birds, in a stage of plumage which occurs also among continental specimens. Placing together four adults from the Galapagos

with one from Socorro Island, off west coast of Mexico, and three from Louisiana, I find it impossible to detect any differences of coloration or proportions that are not of a purely individual character.

ASCERTAINED RANGE OF THE GENUS NYCTANASSA, STEJNEGER, IN THE GALAPAGOS ARCHIPELAGO.



1. *Nyclanassa violacea* (Linnæus).

Measurements of Nyctanassa violacea.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Depth of bill at posterior end of nostril.	Tarsus.	Middle toe.
90357	U. S.	Adult male	Wheatland, Indiana.	May 3, 1883	11.25	4.35	2.98	.90	4.00	2.53
90350	U. S.	Adult female	do	do	10.90	4.15	2.62	.81	3.80	2.28
101406	U. S.	Adult male	Lee County, Iowa.	June 2, 1883	10.65	4.12	2.92	.90	3.75	2.42
108412	U. S.	do	Cameron Parish, Louisiana.	June —, 1883	11.75	4.27	2.63	.88	3.95	2.57
108413	U. S.	Adult female	do	do	11.50	4.32	2.92	.91	4.10	2.45
50862	U. S.	Adult male	Socorro Island, West Mexico.		10.85	4.22	2.70	.95	3.32	2.50
117501	U. S.	do	do	Mar. 7, 1889	10.50	4.18	2.45	.91	3.22	2.40
67920	U. S.	do	Talamanca, Costa Rica.		11.25	4.28	2.90	.85	3.97	2.38
			Average		11.08	4.24	2.76	.89	3.76	2.44
116087	U. S.	do	Hood Island, Galapagos.	Apr. 7, 1888	10.70	4.28	2.83	.95	3.70	2.47
229	B. & A.	do	do	July 6, 1891	10.60	3.85	2.80	.92	3.60	2.65
227	B. & A.	do	Gardner Island, Galapagos.	do	11.15	3.87	2.65	.93	3.70	2.47
305	B. & A.	do	Albemarle Island, Galapagos.	July 14, 1891	10.70	4.00	2.45	.95	3.60	2.50
117	B. & A.	Juvenile female.	Chatham Island, Galapagos.	June 25, 1891	10.00	3.88	2.56	.91	3.60	2.40
116060	U. S.	Adult female	Indefatigable Island, Galapagos.	Apr. 12, 1888	10.70	4.20	2.80	.90	3.50	2.35
			Average		10.64	4.01	2.68	.93	3.61	2.47

Family PHŒNICOPTERIDÆ.

Genus PHŒNICOPTERUS, Linnæus.

Phœnicopterus, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 139. Type, *P. ruber*, Linnæus.

Range.—Tropical and subtropical portions of both hemispheres. Galapagos Archipelago (one species of the Antillean subregion).

PHŒNICOPTERUS RUBER, Linnæus.

Phœnicopterus ruber, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 139.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 498 (Galapagos Archipelago).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889 (1890), p. 114 (James and Charles islands).—BAIRD, BREWER and RIDGWAY, Water Birds N. Amer., I, 1884, p. 415.—RIDGWAY, Man. N. Amer. Birds, 1887, p. 121.

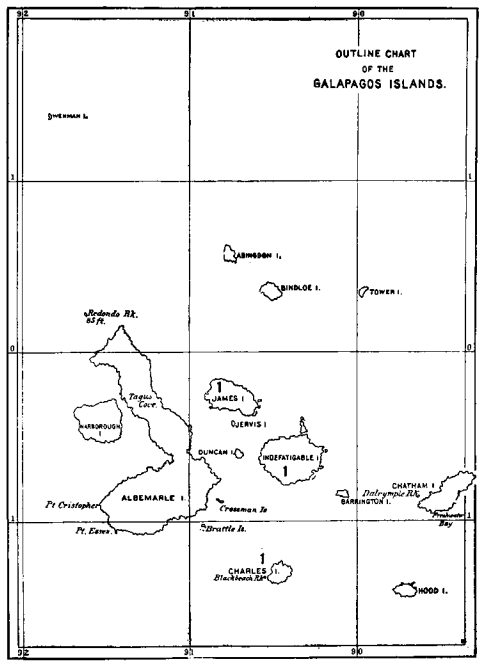
Phœnicopterus glyphorhynchus, GRAY, Ibis, 1869, p. 442, pl. XIV, fig. 5 (Galapagos Islands).

Range.—Coasts of the Caribbean Sea and Gulf of Mexico (in part), north to the Bahamas and southern Florida. Galapagos Archipelago: Charles and James islands (Townsend, Baur and Adams); Indefatigable Island (Habel[1]).

[1] Seen only.

Having carefully compared a series of twenty adult flamingoes from the Galapagos with a still larger number from the Bahamas, I am unable to appreciate any difference between them except the slightly smaller average size and distinctly paler coloration of the former. Regarding the obvious color differences, however, it should be noted that the Bahama series is a selected lot from a much larger number of

ASCERTAINED RANGE OF THE GENUS PHŒNICOPTERUS, LINNÆUS, IN THE GALAPAGOS ARCHIPELAGO.



1. *Phœnicopterus ruber* (Linnæus).

exceptionally fine skins, and I feel very doubtful whether, if they were compared with a similar series of Galapagos specimens, any difference could be detected. Certain it is that while the brightest colored adult male from the Galapagos is decidedly less intensely colored than the majority of those from the Bahamas, specimens occur among the latter which are quite as pale as any of the Galapagos lot.

The brightest colored Galapagos male may be described as follows: No. 125851, U.S.N.M.; Charles Island, Galapagos, July 2, 1891; Messrs.

Baur and Adams. Head and neck entirely slightly pinkish flame scarlet, the feathers pinkish white at the base; the color is palest on the extreme anterior portion of the head, becoming very gradually brighter on the lower neck, where it is very rich pinkish flame scarlet. Wings rich pinkish flame scarlet, the tertials very slightly paler; secondaries and primaries uniform deep black, including shafts; upper back mixed flame scarlet and salmon-pink; scapulars pinkish white, some of the feathers more decidedly pink, and a few feathers of bright flame scarlet mixed in the anterior portion; median line of the back and rump scarlet-pink; tail clear salmon-pink, the outer webs deeper; upper tail-coverts more mixed with pale pink. Under parts pale salmon color, tinged with deeper salmon-pink; post-femoral region carmine-pink; tibiæ whitish, tinged with salmon-pink. Basal half of maxilla buff (in dried skin), tinged with salmon-pink, especially anteriorly on top; bare skin of lores, etc., buff, without pink tinge, except between rami of mandible; broad basal half of mandible bright scarlet, paler below and at base; terminal portion of bill deep black; legs and feet reddish (apparently deep coral red in life), the claws pusky horn color. Wing, 15.75; tail, 5.37; culmen (chord), 4.60; depth of bill through middle, at gonydeal angle, 1.66; greatest width of bill anterior to bend, 1.09; naked tibia, 7.60; tarsus, 11.75; middle toe, 2.75.[1]

The fresh colors of the bill and other unfeathered parts are as follows, according to Mr. Adams' MS. notes:

Iris naples yellow; eyelids ochraceous-buff; white skin at basal portion of bill tinged with same color as eyelids; small patches of color in nasal region same color as feathers on head; legs pinkish vinaceous, joints of tarsi and tibiæ lighter than wine purple, the edge of the webs pink; edge of each scale on legs lighter than other portions; under side of toes sulphur yellow.

Adult females differ from the males more in size than in color, being decidedly smaller but scarcely less bright. A very young bird may be thus described:—

Downy young.—Grayish white, becoming nearly pure white on forehead, cheeks, median line of back, whole rump, and median under parts; bill pale brownish, dusky terminally; naked lores dusky; legs and feet brownish black. Bill nearly straight.

[1] According to Mr. Adams' MS. notes, adult males are 3 feet 6½ inches to 3 feet 8½ inches in total length, adult females measuring 3 feet 3½ inches to 3 feet 3¾ inches.

Measurements of Phœnicopterus ruber.

a. GALAPAGOS SPECIMENS.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Depth of bill across middle.	Greatest width of bill anterior to bend.	Naked tibia.	Tarsus.	Middle toe.
116032	U. S.	Adult male	James Island, Galapagos.	Apr. 12, 1888	16.25	5.80	5.03	1.65	1.15	8.80	12.00	3.15
(a)	B. & A.	do	do	Aug. 12, 1891	16.50	5.58	4.71	1.61	1.11	8.00	11.40	3.03
(b)	B. & A.	do	do	do	15.95	5.00	4.90	1.58	1.10	8.60	12.05	2.93
(c)	B. & A.	do	do	do	16.25	5.07	4.80	1.60	1.08	8.35	12.00	3.21
116139	U. S.	do	Charles Island, Galapagos.	Apr. 8, 1888	15.75	5.73	5.02	1.62	1.05	8.60	13.00	.....
116140	U. S.	do	do	do	16.10	5.85	5.02	1.65	1.12	8.20	12.30	3.09
174	B. & A.	do	do	July 1, 1891	16.40	5.87	4.70	1.53	1.04	8.00	12.00	3.10
176	B. & A.	do	do	do	16.15	5.61	5.02	1.59	1.10	9.00	12.05	3.03
181	B. & A.	Immature male.	do	do	15.15	5.33	4.46	1.53	.97	8.15	11.95	3.06
182	B. & A.	Adult male	do	July 2, 1891	15.85	5.90	4.65	1.60	1.10	8.20	12.00	3.02
184	B. & A.	do	do	do	15.75	5.37	4.60	1.66	1.09	7.60	11.75	2.75
185	B. & A.	do	do	do	15.70	4.98	4.67	1.49	1.02	7.20	11.00	2.94
			Average		15.99	5.51	4.80	1.59	1.08	8.22	11.96	3.02
116142	U. S.	Adult female	Charles Island, Galapagos.	Apr. 8, 1888	14.75	5.15	4.77	1.45	1.00	6.10	10.20	2.70
125852	U. S.	do	do	July 2, 1891	14.40	5.25	4.88	1.48	1.10	7.00	10.40	2.72
116141	U. S.	do	do	Apr 8, 1888	14.25	4.60	4.42	1.38	.98	6.90	9.50	.....
177	B. & A.	do	do	July 1, 1891	15.50	5.27	4.30	1.50	1.00	6.70	10.20	2.95
179	B. & A.	do	do	do	15.00	5.10	4.48	1.40	1.00	7.45	10.20	2.70
180	B. & A.	do	do	do	14.90	5.55	4.50	1.44	1.00	7.30	10.40	2.75
183	B. & A.	do	do	July 2, 1891	14.75	5.00	4.70	1.46	1.07	6.80	10.25	2.86
(d)	B. & A.	do	James Island, Galapagos.	Aug. 12, 1888	15.30	5.19	4.61	1.51	1.00	7.00	10.50	2.83
(e)	B. & A.	do	do	do	15.00	5.42	4.48	1.48	1.00	6.90	10.70	2.82
			Average		14.87	5.18	4.57	1.46	1.02	6.81	10.26	2.79

b. BAHAMAN SPECIMENS.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Greatest height of bill through middle.	Greatest width of bill.	Naked tibia.	Tarsus.	Middle toe.
135004	U. S.	Adult male	Bahamas	Mar. 23, 1893	16.50	6.00	5.85	1.67	1.12	8.30	14.40	3.12
135005	U. S.	[do]	do	Mar. 12, 1893	16.00	6.30	5.15	1.57	1.05	8.25	11.65	3.00
135006	U. S.	[do]	do	Feb. 26, 1893	15.75	6.00	5.00	1.63	.99	8.85	12.50	3.20
135007	U. S.	do	do	Feb. 9, 1893	17.10	6.20	5.20	1.62	1.12	9.50	13.75	3.42
135009	U. S.	do	do	May 26, 1892	16.80	5.80	5.08	1.75	1.10	9.80	14.30	3.35
.....	.....	do	do	Mar. 31, ——	16.50	.....	5.05	.....	.....	.....	13.25	3.20
.....	.....	do	do	Mar. 8, ——	16.00	.....	5.05	.....	.....	.....	13.25	3.05
			Average		16.38	6.06	5.13	1.65	1.08	8.94	13.30	3.19
135008	U. S.	Adult female	Bahamas	Feb. 17, 1893	15.00	5.15	4.70	1.43	.93	7.75	11.00	2.70
135010	U. S.	do	do	Mar. 3, 1893	15.25	5.48	4.80	1.47	.92	8.00	12.20	2.95
135011	U. S.	do	do	Mar. 11, 1893	14.75	5.25	4.78	1.47	1.00	6.80	10.20	1.67
135012	U. S.	do	do	Feb. 18, 1893	14.65	5.12	4.58	1.44	1.02	7.50	10.50	2.82
135013	U. S.	do	do	Mar. 10, 1893	15.40	5.50	4.63	1.40	.95	8.30	11.60	2.80
135014	U. S.	do	do	May 6, 1892	14.75	5.70	4.50	1.49	1.00	6.25	9.00	.....
135015	U. S.	do	do	May 26, 1892	15.10	5.40	4.85	1.50	.92	7.60	10.80	.....
.....	D. P. I.	do	do	Mar. 27, 1893	15.00	.....	4.80	.....	.....	.....	11.60	2.80
.....	D. P. I.	do	do	Mar. 3, 1893	14.40	.....	4.90	.....	.....	.....	11.75	2.75
			Average		14.92	5.37	4.70	1.46	.96	7.46	10.96	2.64

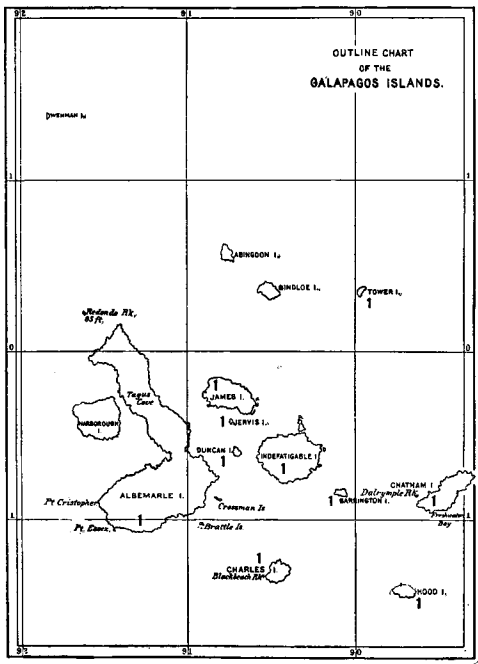
Family ANATIDÆ.

Genus PŒCILONETTA, Eyton.

Pœcilonetta, EYTON, Monog. Anat., 1838, p. 16. Type, *Anas bahamensis*, Linnæus.

Range.—South America in general, and north through the West Indies to the Bahamas. Galapagos Archipelago (one peculiar species).

ASCERTAINED RANGE OF THE GENUS PŒCILONETTA, EYTON, IN THE GALAPAGOS ARCHIPELAGO.



1. *Pœcilonetta galapagensis*, Ridgway.

PŒCILONETTA GALAPAGENSIS, Ridgway.

Pœcilonetta bahamensis (nec *Anas bahamensis* LINNÆUS), GOULD, Zool. Voy. Beagle, III, Birds, 1841, p. 135 (Galapagos Archipelago).

Anas bahamensis (nec LINNÆUS), SUNDEVALL, Proc. Zool. Soc., 1871, p. 126 (Galapagos Islands).

Dafila bahamensis, SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Indefatigable Island).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 499 (Indefatigable Island); Proc. Zool. Soc., 1883, p. 428 (Charles Island).

Pœcilonetta galapagensis, RIDGWAY, Proc. U. S. Nat. Mus., XII, No. 767, Feb. 5, 1890, p. 115 (Charles Island, Galapagos Archipelago; collection U. S. Nat. Mus.).

Specific characters.—Similar to *P. bahamensis* (Linnæus), but white on sides of head thickly speckled with brown (instead of being quite immaculate) and top of head grayer brown.

Range.—Galapagos Archipelago: No locality (Darwin, Kinberg); South Albemarle Island (Baur and Adams); Duncan Island (Baur and Adams); Charles Island (Markham, Townsend, Baur and Adams); Hood Island (Habel,[1] Baur and Adams); Chatham Island (Baur and Adams); Barrington Island (Baur and Adams); Indefatigable Island (Habel, *Albatross*, Baur and Adams); Jervis Island (Baur and Adams); Tower Island (Baur and Adams).

Adult male.—Type, No. 115931; U.S.N.M.; Charles Island, Galapagos, April 8, 1888; U. S. S. *Albatross.* Pileum, sides of head down to below the eyes, and hind neck, pale sepia brown or hair brown, speckled with dusky, these markings larger on pileum; back and anterior scapulars dusky grayish brown, the feathers with paler grayish brown margins; lower back and rump plain dusky grayish brown; posterior scapulars dusky grayish brown, margined with dull buffy; wing-coverts plain brownish slate, the greater sharply tipped with deep cinnamon-buff; secondaries metallic green, washed with copper-bronze, crossed about midway of the exposed portion by a narrow band (about 0.12–0.15 wide) of velvety black, the succeeding portion deep cinnamon-buff; tertials broadly edged with paler cinnamon-buff; primaries dusky brownish slate. Upper tail-coverts and tail pale pinkish buff (middle tail-feathers nearly white), the concealed portions of the feathers more grayish. Chin, throat, and fore neck immaculate white, this separated from the brown of sides of head and neck by a speckled space about 0.40 of an inch wide; rest of under parts pale brown (intermediate between fawn color and isabella color), thickly spotted with dusky, the flanks pale fawn color, with larger spots, and the under tail-coverts plain pale fawn color, the longer ones with dusky mesial streaks; axillars white, the terminal portion, mesially, mottled with dusky; under wing-coverts plain brownish slate, the last row white. Bill blackish, with a large space on lower basal portion of maxilla reddish; legs and feet dusky brownish. Length (skin), 16.75; wing, 8.10; tail, 3.70; culmen, 1.78; greatest width of bill, 0.72; tarsus, 1.48; middle toe, 1.62.

Adult female.—No. 116143, U.S.N.M.; same locality, etc. Similar to the male, but smaller, lower fore neck speckled with dusky brown, tail-coverts spotted with dusky, and reddish space at lower base of maxilla much smaller. Length (skin), 16; wing (quills molting); tail, 3.15; culmen, 1.60; greatest width of bill, 0.65; tarsus, 1.42; middle toe, 1.55.

Specimens of *P. bahamensis* with which the above examples have been compared, and from all of which they differ in the characters mentioned in the diagnosis, are from the West Indies (Bahamas, 1; Guadeloupe, 3; Barbuda, 1); Buenos Ayres, 1, and Chile, 2.

The collection of Messrs. Baur and Adams contains 15 additional

[1] Not collected.

specimens (13 from Chatham, 2 from Albemarle). These show that the characters upon which *P. galapagensis* was separated from *P. bahamensis* are quite constant, every specimen, females as well as males and young as well as adults, showing the distinct speckling of the sides of the head.

"Light-colored triangular space on sides of upper mandible at base madder brown tinged with vermilion." (Adams, MS.)

Genus QUERQUEDULA, Stephens.

Querquedula, STEPHENS, Gen. Zool., XII, Pt. II, 1824, p. 142. Type, *Anas querquedula*, Linnæus.

Range.—Nearly cosmopolitan. Galapagos Archipelago (one species, said to be identical with a species of the more southern parts of South America).

QUERQUEDULA VERSICOLOR (Vieillot).

Anas versicolor, VIEILLOT, Nouv. Dict. d'Hist. Nat., V, 1816, p. 109

Querquedula versicolor, CASSIN, Gilliss's Exped., II, 1856, p. 203.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 499 (Galapagos, fide Sundevall).—SCLATER and SALVIN, Proc. Zool. Soc., 1876, p. 388 (description and synonymy).

Anas maculirostris, LICHTENSTEIN, Verz. Doubl. 1823, p. 81.—SUNDEVALL, Proc. Zool. Soc., 1871, p. 126 (Galapagos Islands).

Range.—Southern South America, north to Argentine Republic and Chile. Galapagos Archipelago (no locality, Kinberg).

Family COLUMBIDÆ.

Genus NESOPELIA, Sundevall.

Nesopelia, SUNDEVALL, Meth. Nat. Av. Disp., 1872, p. 99. Type, *Zenaida galapagoensis*, Gould.

Generic characters.—Similar to *Zenaida*, Bonaparte,[1] but tail proportionally shorter and less graduated, composed of 12 instead of 14 rectrices; bill longer and stouter, with arched terminal portion of maxilla half as long as middle toe (without claw) instead of much less; legs and feet larger and stouter.

Range.—Peculiar to the Galapagos Archipelago.

NESOPELIA GALAPAGOENSIS (Gould).

Colombi-Galline des Gallapagos, NÉBOUX, Rev. Zool., 1840, p. 290 (Charles Island, Galapagos Archipelago).

Zenaida galapagoensis, GOULD, Zool. Voy. Beagle, III, Birds, 1841, p. 115, pl. XLVI (Galapagos Archipelago).—SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Indefatigable and Bindloe islands.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 499 (Charles, Indefatigable, Bindloe, and James islands).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 116 (Indefatigable, Duncan, James, and Hood islands).

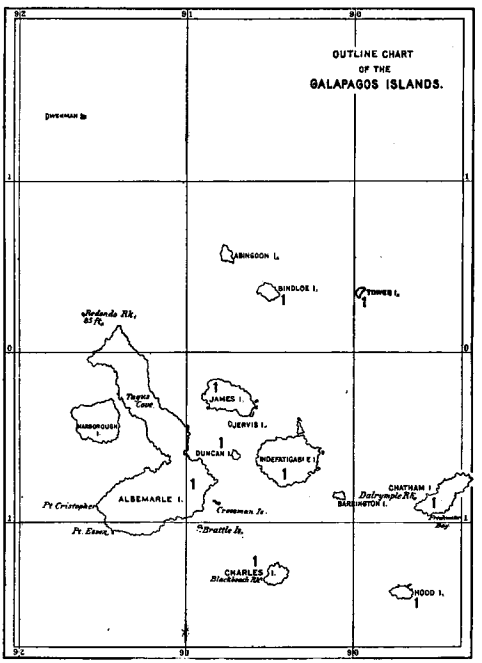
[1] *Zenaida*, Bonaparte, Geog. and Comp. List, 1838, p. 41. Type, *Columba zenaida*, Bonaparte.

Columba (*Zenaida*) *galapagensis*, SUNDEVALL, Proc. Zool. Soc., 1871, p. 125 (James Island).

Nesopelia gallapagensis, SUNDEVALL, Meth. Nat. Av., 1872, p. 99.

Nesopelia galapagoensis, SALVADORI, Cat. Birds Brit. Mus., XXI, 1893, p. 391 (Indefatigable and Bindloe islands).

ASCERTAINED RANGE OF THE GENUS NESOPELIA, SUNDEVALL.



1. *Nesopelia galapagoensis* (Gould).

Specific characters.—Wing-coverts conspicuously spotted with black and streaked with white, the outermost middle and greater coverts with their outer webs almost wholly white; a light-colored longitudinal auricular band, margined above and below by a dusky streak; tail with a black subterminal band, extending entirely across all the feathers, except sometimes the middle pair; under tail-coverts and tip of tail gray or brownish gray. Wing, 4.72–5.45; culmen, 0.55–0.74; tarsus, 0.82–1.03.

Range.—Galapagos Archipelago: Albemarle Island (Habel);[1] Duncan Island (*Albatross*); Charles Island (Néboux, Jones); Hood Island (Habel,[1]

[1] Not collected.

Albatross); Chatham Island (Jones, Baur and Adams); Indefatigable Island (Darwin ?, Habel, *Albatross*); James Island (Kinberg, *Albatross*, Baur and Adams); Tower Island (Baur and Adams); Bindloe Island (Habel).

Adult male.—No. 116020, U.S.N.M.; James Island, Galapagos, April 11, 1888; C. H. Townsend. Top of head dull chocolate brown, lighter on forehead, much duller on crown, the color changing gradually on occiput and hind neck to warm sepia brown; back brighter brown, the lower portion with large roundish spots of dull blackish; lower back, rump, upper tail-coverts and median tail-feathers plain olive brown, the last with an indication of a subterminal dusky band; wing-coverts mainly light brown (intermediate between broccoli and wood brown), thickly marked with large roundish and oblong spots of black (crowded into a large patch on the greater coverts) and interspersed with streaks of white (bordering upper and posterior margins of the black spots), the outermost middle and greater coverts with their outer webs chiefly white, forming an elongated patch of this color; tertials more rusty brown, with a large, posteriorly rounded, patch of black on each web; secondaries dusky, very narrowly edged with pale grayish brown and rather broadly tipped with the same; innermost primaries colored like secondaries, but longer quills (except outermost) narrowly edged with white; outer webs of rectrices, except lateral one, chiefly olive brown, both webs of the outermost and inner webs of the others, except middle pair, deep gray, all, except middle pair, crossed by a broad band of black, the broad gray terminal band rather lighter than the basal portion. A broad longitudinal patch of brownish whitish on auricular region (commencing beneath eyes), margined above and below by a streak of black;[1] sides of neck richly glossed with bright metallic solferino purple, changing to golden bronze; chin dull light vinaceous-cinnamon, deeper on throat, and gradually passing into vinaceous-chocolate on fore neck and chest, the breast rather lighter and slightly more cinnamomeous; belly pale fawn color, passing into pale pinkish buff on anal region; sides and flanks plain gray (No. 7), the under wing-coverts and axillars similar but rather deeper (No. 6 gray); under tail-coverts mouse gray, tinged with light brown at tips, the inner webs of the longest feathers with a concealed longitudinal space of dusky. Bill black; legs and feet (in dried skin) deep brownish yellow.[2] Length (skin), 8.90; wing, 5.40; tail, 3; culmen, 0.64; tarsus, 1; middle toe, 0.90.

[1] The head of the specimen described is in rather bad condition, and does not show distinctly the exact character of the markings. In examples not thus defective, the uppermost black streak passes underneath the bare orbital space to the anterior angle of the same, where it meets another but narrower black line which borders the upper margin of the bare orbital space for its whole length, running into the auricular stripe at the posterior angle of the orbital space.

[2] "Bare skin round eye cobalt blue, tending toward purplish; feet and legs a little darker than coral red." (Adams, MS.) Iris dark brown (Habel).

Adult female.—No. 116021, U.S.N.M.; same data. Similar to the adult male, as described, but smaller and rather duller colored; the metallic gloss on sides of neck less brilliant and much restricted; the black spots on wing-coverts rather more crowded; top of head less purplish brown, and under parts more cinnamomeous, especially on belly. Length (skin), 7.80: wing, 4.90; tail, 2.92: culmen, 0.60; tarsus, 0.88; middle toe, 0.84.

Young.—No. 52410, U.S.N.M.; James Island, Galapagos; received from Professor Sundevall. Much duller in color than adults, with markings and colors far less strongly contrasted: spots on wing-coverts and scapulars dark sooty brown, intermixed with smaller spots of light cinnamon; prevailing color of under parts deep wood brown, darker on chest, where the feathers have paler terminal margins; the head and neck duller brown, indistinctly spotted above, especially on occiput, with dull cinnamon, the sides of the neck without trace of metallic gloss; remiges conspicuously margined with light rusty, and general color of rectrices deep broccoli brown or drab instead of gray.

There are some slight variations in plumage noticeable between specimens from different islands, which may or may not be of local significance, the series of specimens being too small to determine the question. Examples from Chatham Island are, as may be seen from the subjoined measurements, decidedly smaller than those from other localities, but having only one skin for examination, and that a very poor one (those belonging to Dr. Baur having been returned to him), I am unable to state whether there are any other differences.

Measurements of Nesopelia galapagoensis.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
116020	U. S.	Adult male	James Island	Apr. 11, 1888	5.40	3.00	0.64	1.00	0.90
115899	U. S.	do	Duncan Island	Apr. 13, 1888	5.10	3.02	.70	.92	.87
125993	U. S.	do	do	Apr. 2, 1891	5.32	3.13	.68	1.00	.90
			Average		5.21	3.07	.69	.96	.88
116054	U. S.	do	Indefatigable Island.	Apr. 12, 1888	5.20	2.90	.74	1.00	.88
125994	U. S.	do	do	Apr. 2, 1891	5.20	2.95	.....	.90	.85
452	B. & A.	do	do	Aug. 7, 1891	4.82	2.50	.72	1.01	.95
453	B. & A.	do	do	do	5.12	2.70	.68	1.01	.92
			Average		5.08	2.76	.71	.98	.90
101318	U. S.	Adult male ?	Chatham Island	Aug. 19, 1884	4.90	2.62	.65	.93	.88
102	B. & A.	Adult male	do	June 22, 1891	4.85	2.40	.70	.91	.88
110	B. & A.	do	do	do	4.80	2.25	.70	.82	.91
126	B. & A.	Adult male ?	do	June 25, 1891	4.90	2.45	.72	.90	.90
α	B. & A.	Adult male	do	June 13, 1891	4.85	2.20	.70	1.00	.92
			Average		4.86	2.40	.69	.91	.90
116081	U. S.	do	Hood Island	Apr. 7, 1888	5.22	3.00	.68	.95	.87
116082	U. S.	do	do	do	5.45	3.12	.72	.98	.90
149819	U. S.	do	do	do	5.40	3.15	.70	1.03	.88
149820	U. S.	do	do	do	5.35	3.02	.70	.95	.90
			Average		5.35	3.07	.70	.97	.89

Measurements of Nesopelia galapagoensis—Continued.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Exposed culmen.	Tarsus.	Middle toe.
116021	U. S.	Adult female.	James Island....	Apr. 11, 1888	4.90	2.92	.60	.88	.84
116022	U. S.	.....do.....	.....do.....	.....do.....	4.85	2.85	.61	.86	.79
116023	U. S.	.....do.....	.....do.....	.....do.....	4.87	2.68	.65	.88	.80
116024	U. S.	.....do.....	.....do.....	.....do.....	4.77	.....	.60	.93	.80
			Average		4.85	2.81	.61	.89	.81
115898	U. S.	Adult female?	Duncan Island..	Apr. 13, 1888	4.73	2.70	.59	.88	.76
116056	U. S.	Adult female.	Indefatigable Island.	Apr. 12, 1888	4.85	2.70	.63	.90	.80
116057	U. S.	.....do.....	.....do.....	.....do.....	4.73	2.63	.55	.90	.80
			Average		4.79	2.66	.59	.90	.80
116083	U. S.	.....do.....	Hood Island.....	Apr. 7, 1888	4.90	2.70	.65	.91	.80
116084	U. S.	.....do.....	.....do.....	.....do.....	4.88	2.72	.68	.92	.81
149822	U. S.	.....do.....	.....do.....	.....do.....	4.72	2.68	.63	.85	.79
			Average		4.83	2.70	.65	.89	.80

Family RALLIDÆ.

Genus PORZANA, Vieillot.

Porzana, VIEILLOT, Analyse, 1816, p. 61. Type, *Rallus porzana*, Linnæus.

Range.—Cosmopolitan. Galapagos Archipelago (two peculiar species).

PORZANA SPILONOTA (Gould).

Zapornia spilonota, GOULD, Zool. Voy. Beagle, III, Birds, 1841, p. 132, pl. XLIX ("Galapagos Archipelago"[1]).

Ortygometra spilonota, Gray, List Gralla Brit. Mus., 1844, p. 119.

Porzana spilonota, SCLATER and SALVIN, Proc. Zool. Soc., 1868, p. 456; 1870, p. 323 (Indefatigable Island).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 500 (James and Indefatigable islands).

Creciscus spilonotus, SHARPE, Cat. Birds Brit. Mus., XXIII, 1894, p. 137 (James and Indefatigable islands).

Range.—Galapagos Archipelago: Indefatigable Island (Habel); James Island (Darwin, fide Salvin).

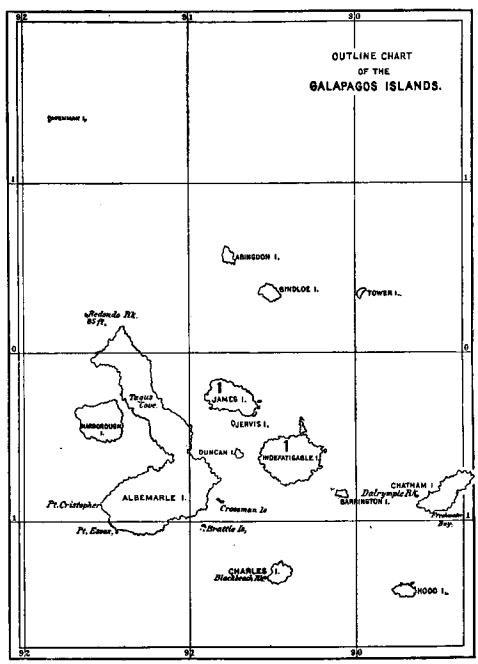
Specific characters.—"Adult male: Uniform chocolate brown, including the wings; lower back, rump, and tail blacker; quills dusky brown, externally chocolate like the back; head all round and under surface of the body dark slaty gray, the lores and sides of face blackish; sides of body and flanks chocolate brown; under tail-coverts blackish with white bars; 'bill black, the lower mandible blackish brown; feet olive-brown; iris red' (A. Habel). Total length, 4.5 inches; culmen, 0.7; wing, 2.75; tail, 0.9; tarsus, 0.8; middle toe and claw, 1.1.

"The male described is from Indefatigable Island, and three other specimens from the same island in the Salvin-Godman collection have

[1] The type specimen has apparently been lost.

tiny white spots on the wing-coverts and inner secondaries, and have the lower abdomen almost pure white. This peculiar character is not easily explained as a sign of age or sex, but it is probable that the white spots disappear with age, as they vary in number in all the specimens in the Museum. The type specimen seems not to have been transferred with the rest of the Zoological Society's Collection." (Sharpe.)

ASCERTAINED RANGE OF THE GENUS PORZANA, VIEILLOT, IN THE GALAPAGOS ARCHIPELAGO.



1. *Porzana spilonota* (Gould).
2. *Porzana galapagoensis*, Sharpe. ("Galapagos.")

PORZANA GALAPAGOENSIS, Sharpe.

Porzana spilonota (nec *Ortygometra spilonota*, GOULD), SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 500 (part).

Porzana galapagoensis, SHARPE, Cat. Birds Brit. Mus., XXIII, 1894, p. 113 (Galapagos; British Museum).

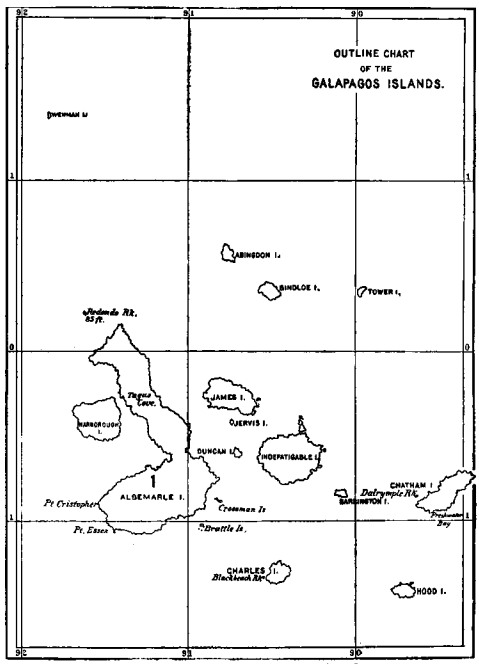
Specific characters.—"Adult male: Similar to *O.* [*Porzana*] *tabuensis*, but distinguished by the absence of the white edge to the first primary

and also by the shorter wings and tail. Total length, 5.5 inches; culmen, 1.6; wing, 2.9; tail, 1; tarsus, 1; middle toe and claw, 1.2.

"*Habitat.*—Galapagos Archipelago; exact island not indicated."

I have not seen a specimen of this species, which Mr. Sharpe places in a different genus from *P. spilonota*. *P. tabuensis* (*Rallus tabuensis*, Gmelin),[1] with which Mr. Sharpe compares it, is described as being plain

ASCERTAINED RANGE OF THE GENUS GALLINULA, BRISSON, IN THE GALAPAGOS ARCHIPELAGO.



1. *Gallinula galeata* (Lichtenstein) ?

chocolate brown above, darkening into blackish on upper tail-coverts and tail, the sides of head and under parts slate-gray, paler on throat, the under tail-coverts black, with white bars; bill black, feet reddish. It inhabits Polynesia, New Zealand, the Philippines, etc.

Genus GALLINULA, Brisson.

Gallinula, BRISSON, Orn., VI., 1760, p. 2. Type, *Fulica chloropus*, Linnæus.

Range.—Nearly cosmopolitan. Galapagos Archipelago (one species, apparently identical with the common continental one).

[1] Syst. Nat., I, 1788, p. 717.

GALLINULA GALEATA (Lichtenstein).

Crex galeata, LICHTENSTEIN, Verz. Doubl., 1823, p. 80.

Gallinula galeata, BONAPARTE, Amer. Orn., IV, 1832, p. 128.—BAIRD, BREWER, and RIDGWAY, Water Birds N. Amer., I, 1884, 388.—RIDGWAY, Man. N. Amer. Birds, 1887, p. 141.

Range.—Whole of tropical and most of temperate portions of America. Galapagos Archipelago: Albemarle Island (Baur and Adams).

There are three adult specimens of what I refer provisionally to this species in Dr. Baur's collection from Albemarle. These differ from continental examples of true *G. galeata* in narrower frontal shield and in the lighter hue of their coloration, with apparently less extent of olive on the upper parts and more white on the abdomen as well as along the edge of the wing. Measurements are as follows:

Measurements of Gallinula galeata.

Number.	Sex and age.	Date.	Wing.	Tail.	Culmen, including frontal shield.	Bill from nostril.	Tarsus.	Middle toe.
309	Adult female	July 15, 1891	6.36	2.60	1.65	0.57	1.94	2.48
310	Adult male	do	6.70	2.77	1.75	.62	2.03	2.35
393	do	July 30, 1891	6.36	2.66	1.70	.55	2.18	2.45
	Average		6.47	2.68	1.70	.58	2.05	2.43

"Frontal plate orange-vermilion; tip of beak citron yellow; base of beak poppy red; ring on tibia just below feathers same as frontal plate; legs and feet oil green." (Adams, MS.)

Family HÆMATOPODIDÆ.

Genus HÆMATOPUS, Linnæus.

Hæmatopus, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 152. Type, *H. ostralegus*, Linnæus.

Range.—Seacoasts of both hemispheres. Galapagos Archipelago (one species, very closely related to, perhaps identical with, a Lower California species).

HÆMATOPUS GALAPAGENSIS, Ridgway.

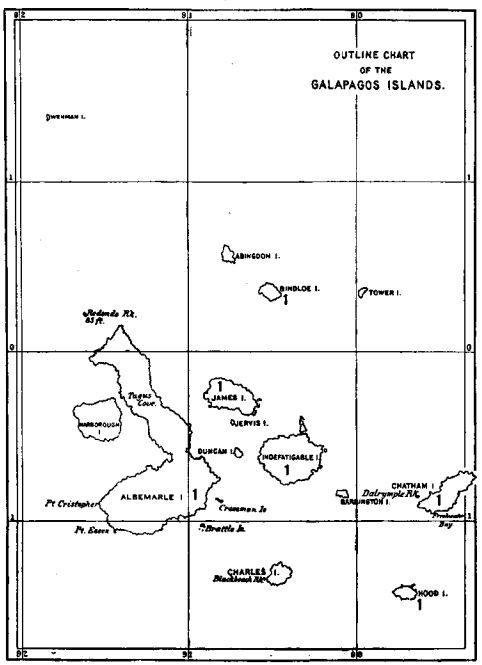
? *Hæmatopus palliatus* (nec TEMMINCK), SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Indefatigable Island, Galapagos Archipelago).—SUNDEVALL, Proc. Zool. Soc., 1871, p. 125 (Galapagos).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 502 (Indefatigable Island).

Hæmatopus galapagensis, RIDGWAY, Auk, III, July, 1886, p. 331 (Chatham Island, Galapagos Archipelago; U. S. Nat. Mus.); Proc. U. S. Nat. Mus., IX, 1886, p. 325 (Chatham Island, Galapagos Archipelago; full description); XII, 1889, pp. 116, 120, 123, 128 (James, Chatham, and Indefatigable islands).

Hæmatopus leucopus galapagensis, SEEBOHM, Geog. Distr. Charadr., 1887, pp. xxii, 307.

Specific characters.—Somewhat similar to *H. palliatus*, Temminck, but differing as follows: Back, scapulars, and wings sooty black, instead of grayish brown; shorter upper tail-coverts entirely black, the longer ones white, varied toward tips with blackish (the median coverts barred or transversely spotted); under primary-coverts chiefly black; white of the wing much more restricted. Wing, 9.50–10.05; tail, 3.50–4.06; culmen, 3.10–3.80; depth of bill at thickest portion in front of nostril, 0.47–0.53; tarsus, 2.07–2.20; middle toe, 1.61–1.89.

ASCERTAINED RANGE OF THE GENUS HÆMATOPUS, LINNÆUS, IN THE GALAPAGOS ARCHIPELAGO.



1. *Hæmatopus galapagensis*, Ridgway.

Range.—Galapagos Archipelago: Albemarle Island (Baur and Adams); Hood Island (Baur and Adams); Chatham Island (Jones); Indefatigable Island (Habel, *Albatross*); James Island (*Albatross*); Bindloe Island (Baur and Adams).

Adult male.—No. 125997, U.S.N.M.; Indefatigable Island, Galapagos, April 2, 1891; C. H. Townsend. Head, neck, and upper part of chest uniform glossy slate-black; rest of upper parts dark sooty brown; wing

with an elongated white patch, occupying the greater part of the innermost secondaries (not tertials), and more or less of the basal or subbasal portion of the outermost, the greater wing-coverts also margined terminally with white; upper tail-coverts white, mottled at tips with dusky, the longer coverts with half an inch or more of their terminal portion sooty black; tail similar in color to the back, but extensively white at base, this occupying about the basal half of the exterior feather. Lower part of chest irregularly clouded or blotched with dusky or white, this mottled space about 1 inch across in middle portion; rest of under parts, including under tail-coverts, immaculate white; under wing-coverts white, with considerable spotting of slate-black along the margin and a large patch of dark brownish slate on the carpo-metacarpal region; inner webs of primaries entirely uniform brownish slate. Bill (in dried skin) reddish; legs and feet (in dried skin) light brownish orange.[1] Length (skin), 16; wing, 10; tail, 3.80; culmen, 3.35; depth of bill at nostril, 0.40; greatest depth of bill, 0.50; tarsus, 2.12; middle toe, 1.61.

Immature.—No. 101320, U.S.N.M.; Chatham Island, August 16, 1884; Dr. William H. Jones, U. S. N. Essentially identical with the adult, as described, in plumage, but bill mainly dusky brown, and legs and feet much duller in color. "Bill red, nearly black toward tip; iris golden yellow; lids reddish; feet slate or grayish." (Jones, MS.) Length (before skinning), 18.25; extent of wings, 33; wing, 10; tail, 3.80; culmen, 3.12; depth of bill at nostrils, 0.43; greatest depth of bill, 0.50; tarsus, 2.20; middle toe, 1.65.

This species is very distinct from every other, except *H. frazari*, Brewster,[2] from Lower California, which is so closely related that eventually, when a larger series has been compared, it may prove to be not separable. Apart from this relationship, *H. galapagensis* is allied both to *H. palliatus* and *H. leucopus*, but more closely to the former, as the following synoptical table, which gives the chief diagnostic characters of all the known American white-bellied *Hæmatopi*, will show:

[1] The fresh colors of the unfeathered parts in two adults obtained by Dr. William H. Jones, U. S. N., on Chatham Island, August 16, 1884, as noted by him, were as follows:

No. 101319, U.S.N.M. (collector's No. 64), adult, type of the species: Bill red; iris golden yellow; eyelids red; feet pale flesh color. Length (before skinning), 18 inches; extent, 32.

No. 101321, U.S.N.M (collector's No. 63), adult: Bill dark red; iris bright golden yellow; eyelids bright red; feet pale flesh color. Length, 17¼; extent, 32½.

Mr. C. F. Adams's notes on specimens collected by himself and Dr. Baur, on Hood and Albemarle islands, July 5-30, 1891, are as follows:

Adult male: "Basal half of bill vermilion, other portion nearly as dark as maroon; legs and feet lighter than buff-pink."

Adult female: "Eyelids red; legs lighter than cream-buff; base of bill Chinese orange, anterior part bay."

[2] *Hæmatopus frazari*, Brewster, The Auk, V, January, 1888, p. 85 (Carmen Island, Gulf of California; collection of William Brewster).

SYNOPSIS OF AMERICAN WHITE-BELLIED HÆMATOPI.

a^1. Rump and lower back white. (Palæarctic region, accidental in Greenland) ..... 1. *H. ostralegus*, Linnæus.

a^2. Rump and lower back dusky.

b^1. Breast white, like belly, etc.

c^1. Mantle grayish brown or brownish slate; upper tail-coverts wholly white in adult and under primary coverts almost wholly white; lower chest not mottled or spotted with black. (Atlantic coast from Nova Scotia to Brazil, and Pacific coast from western Mexico to Chili) ..... 2. H. palliatus, Temminck.

c^2. Mantle dark sooty brown or brownish black; shorter upper tail-coverts entirely blackish and longer ones varied with black at ends; under primary coverts chiefly dusky; lower chest mottled or spotted with dusky.

d^1. Under tail-coverts wholly white; more black on under wing-coverts; tail, 3.50–4.06 (average, 3.80); culmen, 3.10–3.80 (3.32); tarsus, 2.07–2.20 (2.15); middle toe 1.59–1.89 (1.70). (Galapagos Archipelago.) 3. *H. galapagensis*, Ridgway.

d^2. Lateral under tail-coverts spotted or irregularly barred with dusky; less black on under wing-coverts; tail, 3.90–4.25 (average, 4.05); culmen, 2.70–3.05 (2.93); tarsus, 2.18–2.30 (2.24); middle toe, 1.40–1.55 (1.47). (Lower California, both coasts.) 4. *H. frazari*, Brewster.

b^2. Breast wholly black, like head and neck. (Southern extremity of South America) ..... 5. *H. leucopodus*, Garnot.

An examination of eight additional specimens of the Galapagos oyster-catcher reduces the alleged color differences between that bird and the Lower Californian form described as *H. frazari* by Mr. Brewster to two, namely, the smaller amount of dark color on the under surface of the wing and the partially spotted or barred under tail-coverts of the latter. Mr. Brewster says that *H. frazari* is, in part, distinguished by its "distinctly brown (instead of sooty black) back, scapulars, and wing-coverts;" but some of the more recently obtained specimens of *H. galapagensis*, having a mixture of old and new feathers in the plumage, show that this character cannot be depended on, the old feathers having exactly the brown color of the mantle in *H. frazari*. In the coloration of the upper breast, where the black of the upper chest joins the white beneath it, there is no difference between the two supposed forms, the "broad zone of mottled black and white feathers" being just as well developed in *H. galapagensis* as in *H. frazari*.

It is evidently yet too soon to say whether the birds from the two distant regions are really different or not, a larger number of specimens, particularly of the Lower Californian bird, being necessary to decide the question. When, however, we consider the very slight characters on which the separation of *H. frazari* now rests, and also the fact that *Sula nebouxii*, *S. brewsteri*, and *Pelecanus californicus* are found both in the Galapagos and Lower California, it would be not at all surprising should the oyster-catchers of the two distant localities also prove to be identical.

Measurements of Hæmatopus galapagensis.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Depth of bill at nostril.	Greatest depth of bill.	Tarsus.	Middle toe.
101319	U. S.	Adult	Chatham Island	Aug. 16, 1884	9.70	3.90	3.42	.49	.52	2.20	1.72
101320	U. S.	Immature	do	do	10.00	3.80	3.12	.43	.50	2.20	1.65
101321	U. S.	Adult	do	do	.....	4.00	3.15	.48	.51	2.19	1.68
116025	U. S.	Adult male	James Island	Apr. 11, 1888	9.75	3.85	3 23	.45	.51	2.20	1.59
125997	U. S.	do	Indefatigable Island.	Apr. 2, 1891	10.00	3.80	3.35	.40	.50	2.12	1.61
211	B. & A.	Adult female	Hood Island	July 5, 1891	10.05	3.50	3.45	.45	.51	2.19	1.72
231	B. & A.	do	do	July 6, 1891	10.00	4.06	3.45	.51	.52	2.07	1.68
244	B. & A.	do	do	July 7, 1891	10.00	3 70	3.32	50	.53	2.20	1.72
300	B & A	Adult male	Albemarle Island.	July 14, 1891	9.50	3.85	3.18	.50	.49	2.10	1.63
378	B & A.	Adult female	do	July 24, 1891	9.50	3.80	3.80	.47	.51	2.10	1.89
396	B. & A.	Adult male	do	July 30, 1891	9.90	3.55	3.10	.44	.47	2.08	1.64
			Average		9.84	3.80	3.32	.47	.51	2.15	1.70

Measurements of Hæmatopus frazari, Brewster.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Depth of bill at nostril.	Greatest depth of bill.	Tarsus.	Middle toe.
82447	U. S.	Immature male	Coronados Islands, Lower California	May 17, 1881	9.50	4.00	2.70	.45	.52	2.20	1.55
	W. B.	Adult male	La Paz, Lower California [1]	Mar. 7, 1887	9.90	4.25	3.00	.45	.50	2.30	1.40
	W. B.	do	do		9.75	3.90	2.99	.....	.49	2.18	.....
	W. B	do	do		10.27	.....	3.05	.....	.53	2.30	.....
			Average		9.85	4.05	2.93	.45	.51	2.24	1.47

[1] This specimen of Mr Brewster's I have examined and the measurements given are mine. The measurements of the two following are quoted from Mr. Brewster's article in The Auk, V, p. 85.

Family ARENARIIDÆ.

Genus ARENARIA, Brisson.

Arenaria, Brisson, Orn., V, 1760, p. 132. Type, *Tringa interpres*, Linnæus.

Range.—Seacoasts nearly throughout the world, breeding in northern portions of the northern hemisphere. Galapagos Archipelago (one cosmopolitan species during migration).

ARENARIA INTERPRES (Linnæus).

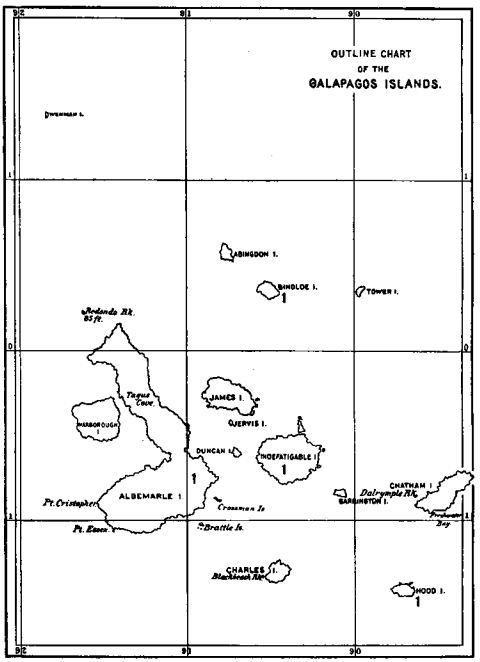
Tringa interpres, LINNÆUS, Sys. Nat., 10th ed., I, 1758, p. 148.

Arenaria interpres, VIEILLOT, Gal. Ois., II, 1834, p. 102.—RIDGWAY, Man. N. Amer. Birds, 1887, p. 180; Proc. U. S. Nat. Mus., XII, 1889, p. 116 (Hood Island, Galapagos Archipelago).

Strepsilas interpres, ILLIGER, Prodr. Orn., 1811, p. 263.—GOULD and DARWIN, Zool. Voy. Beagle, III, Birds, 1841, p. 132 (Galapagos Archipelago).—SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 32 (Indefatigable and Bindloe islands).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 502 (Indefatigable and Bindloe islands).—BAIRD, BREWER, and RIDGWAY, Water Birds N. Amer., I, 1884, p. 119.

Range.—Seacoasts nearly throughout the world. Galagapos Archipelago: Albemarle Island (Baur and Adams); Hood Island (*Albatross*); Indefatigable Island (Habel); Bindloe Island (Habel).

ASCERTAINED RANGE OF THE GENUS ARENARIA, BRISSON, IN THE GALAPAGOS ARCHIPELAGO.



1. *Arenaria interpres* (Linnæus).

Family CHARADRIIDÆ.

Genus SQUATAROLA, Cuvier.

Squatarola, CUVIER, Règne Anim., I, 1817, p. 467. Type, *Tringa squatarola*, Linnæus.

Range.—Breeding in extreme northern portions of northern hemisphere, but nearly cosmopolitan during migration.

SQUATAROLA SQUATAROLA (Linnæus).

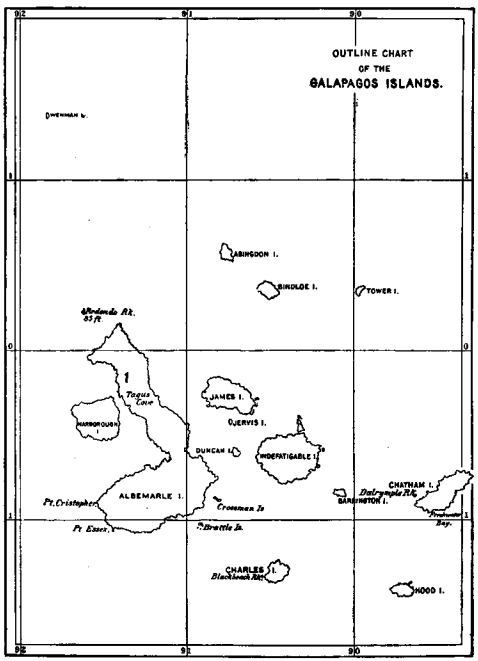
Tringa squatarola, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 149.

Charadrius squatarola, NAUMANN, Vög. Deutschl., VII, 1834, p. 250.—RIDGWAY, Man. N. Amer. Birds, 1887, p. 173.

Squatarola squatarola, TURNER, Proc. U. S. Nat. Mus., VIII, 1885, p. 246.
Tringa helvetica, LINNÆUS, Syst. Nat. 12th ed., I, 1766, p. 250.
Squatarola helvetica, CUVIER, Règne Anim., I, 1817, p. 467.—BAIRD, BREWER and RIDGWAY, Water Birds N. Amer., I, 1884, p. 132.

Range.—Nearly cosmopolitan. Galapagos Archipelago: Albemarle Island, northern part (Baur and Adams).

ASCERTAINED RANGE OF THE GENUS SQUATAROLA, CUVIER, IN THE GALAPAGOS ARCHIPELAGO.



1. *Squatarola squatarola* (Linnæus).

Genus ÆGIALITIS, Boie.

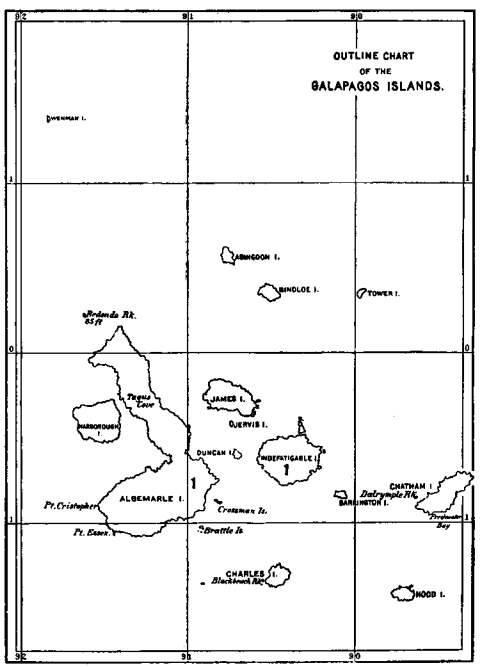
Ægialatis, BOIE, Isis, 1822, p. 558. Type, by elimination, *Charadrius hiaticula*, Linnæus.

Range.—Cosmopolitan. Galapagos Archipelago (one North American species during migration).

ÆGIALITIS SEMIPALMATA, Bonaparte.

Charadrius semipalmatus, BONAPARTE, Jour. Acad. Nat. Sci. Phila., V, 1825, p. 98.
Ægialites semipalmatus, BONAPARTE, Geog. and Comp. List, 1838, p. 45.
Ægialitis semipalmata, BAIRD, Birds N. Amer., 1858, p. 694.—SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Indefatigable Island, Galapagos Archipelago).—SALVIN, Trans. Zool. Soc., IX, Pt. 1x, 1876, p. 501 (Indefatigable Island, Galapagos Archipelago.)—BAIRD, BREWER, and RIDGWAY, Water Birds N. Amer., I, 1884, p. 154.—RIDGWAY, Man. N. Amer. Birds, 1887, p. 176.
Hiaticula semipalmata, GRAY, Zool. Voy. Beagle, III, Birds, 1841, p. 128 (Galapagos Archipelago).

ASCERTAINED RANGE OF THE GENUS ÆGIALITIS, BOIE, IN THE GALAPAGOS ARCHIPELAGO.



1. *Ægialitis semipalmata*, Bonaparte.

Range.—America in general, breeding in arctic and subarctic districts, migrating in winter as far south as Brazil and Peru. Galapagos Archipelago: Albemarle Island (Baur and Adams);[1] Indefatigable Island (Habel).

[1] Four specimens.

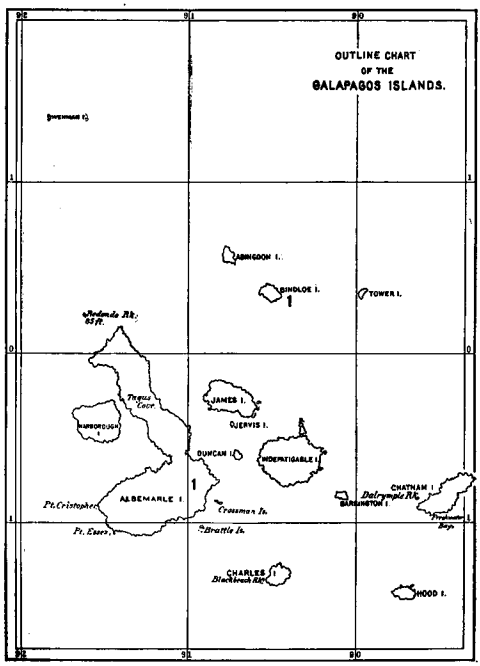
Family SCOLOPACIDÆ.

Genus CALIDRIS, Cuvier.

Calidris, CUVIER, Leç. Anat. Comp., I, 1799–1800, Pl. II. Type, *Tringa arenaria*, Linnæus.

Range.—Cosmopolitan. Galapagos Archipelago (the single widely dispersed species during migration).

ASCERTAINED RANGE OF THE GENUS CALIDRIS, CUVIER, IN THE GALAPAGOS ARCHIPELAGO.



1. *Calidris arenaria* (Linnæus).

CALIDRIS ARENARIA (Linnæus).

Tringa arenaria, LINNÆUS, Syst. Nat., 12th ed., I, 1766, p. 251.

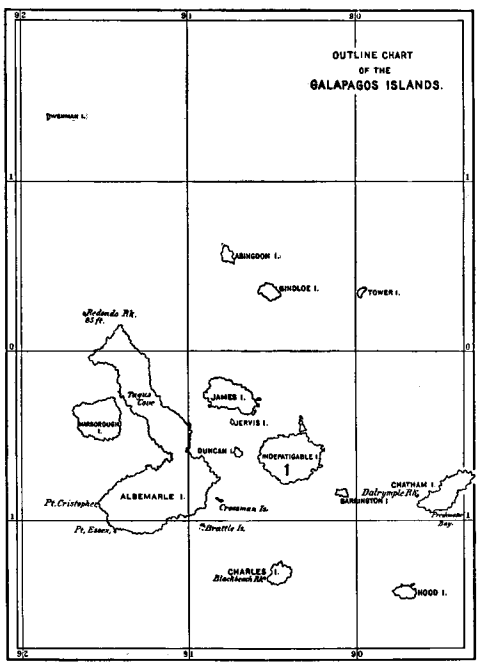
Calidris arenaria, LEACH, Syst. Cat. Brit. Mam. and Birds, 1816, p. 28.—SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Bindloe Island, Galapagos Archipelago).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 503 (Bindloe Island).—BAIRD, BREWER, and RIDGWAY, Water Birds N. Amer., I, 1884, p. 249.—RIDGWAY, Man. N. Amer. Birds, 1887, p. 162.

Range.—Nearly cosmopolitan; migrating southward in America to Chile and Patagonia. Galapagos Archipelago: Albemarle Island (Baur and Adams);[1] Bindloe Island (Habel).

Genus TRINGA, Linnæus.

Tringa, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 148. Type, by elimination, *T. canutus*, Linnæus.

ASCERTAINED RANGE OF THE GENUS TRINGA, LINNÆUS, IN THE GALAPAGOS ARCHIPELAGO.



1. *Tringa minutilla*, Vieillot.

Range.—Cosmopolitan during migration, but breeding in northern (chiefly arctic and subarctic) portions of northern hemisphere. Galapagos Archipelago (one North American species of general distribution during migration).

[1] Eight specimens.

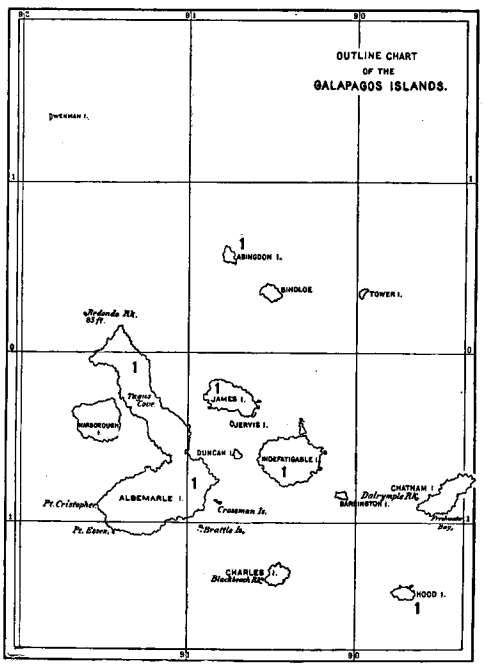
TRINGA MINUTILLA, Vieillot.

Tringa minutilla, VIEILLOT, Nouv. Dict., XXXIV, 1819, p. 452.—SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Indefatigable Island, Galapagos Archipelago).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 504 (Indefatigable Island, Galapagos Archipelago).—RIDGWAY, Man. N. Amer. Birds, 1887, p. 158.

Pelidna minutilla, GOULD, Zool. Voy. Beagle, III, Birds, 1841, p. 131 (Galapagos Archipelago).

Actodromas minutilla, "BONAPARTE, Compt. Rend., 1856."—BAIRD, BREWER, and RIDGWAY, Water Birds N. Amer., I, 1884, p. 236.

ASCERTAINED RANGE OF THE GENUS HETERACTITIS, STEJNEGER, IN THE GALAPAGOS ARCHIPELAGO.



1. *Heteractitis incanus* (Gmelin).

Range.—Whole of America, breeding north of the United States; accidental in Europe. Galapagos Archipelago (Indefatigable Island, Habel).

Genus HETERACTITIS, Stejneger.

Heteractitis, STEJNEGER, Auk, I, July, 1884, p. 236. Type, *Scolopax incanus*, Gmelin.

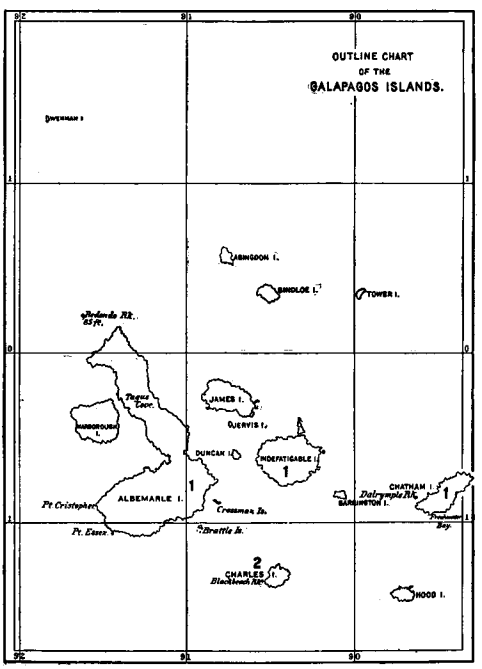
Range.—Shores and islands of the Pacific Ocean. Galapagos Archipelago (one species, of extensive range along the Pacific coast of America and islands of the eastern Pacific).

HETERACTITIS INCANUS (Gmelin)

Scolopax incanus, GMELIN, Syst. Nat., I, Pt. II, 1788, p. 658.

Heteroscelus incanus, COUES, Key, 1872, p. 261.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 503 (Indefatigable and Abingdon islands, Galapagos Archipelago).—BAIRD, BREWER, and RIDGWAY, Water Birds N. Amer., I, 1884, p. 290.

ASCERTAINED RANGE OF THE GENUS NUMENIUS, BRISSON, IN THE GALAPAGOS ARCHIPELAGO.



1. *Numenius hudsonicus*, Latham.
2. *Numenius borealis* (Forster).

Heteractitis incanus, STEJNEGER, Auk, I, July, 1884, p. 236.—RIDGWAY, Man. N. Amer. Birds, 1887, p. 168; Proc. U. S. Nat. Mus., XII, 1889, p. 116 (Hood and James islands).

Totanus fuliginosus, GOULD, Zool. Voy. Beagle, III, Birds, 1841, p. 130 (Galapagos Archipelago).

Totanus brevipes (nec VIEILLOT), SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Indefatigable and Abingdon islands).

Range.—Islands and shores of the eastern Pacific Ocean, from Alaska to the Galapagos Archipelago: Albemarle Island[1] (Baur and Adams); Hood Island (*Albatross*); Indefatigable Island (Habel); James Island (*Albatross*); Abingdon Island (Habel).

Genus NUMENIUS, Brisson.

Numenius, BRISSON, Orn., VI, 1760, p. 311. Type, *Scolopax arquata*, Linnæus.

Range.—Cosmopolitan. Galapagos Archipelago (two North American species during migration).

NUMENIUS HUDSONICUS, Latham.

Numenius hudsonicus, LATHAM, Index Orn., II, 1790, p. 712.—SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Indefatigable Island, Galapagos Archipelago).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 504 (Indefatigable Island).—BAIRD, BREWER, and RIDGWAY, Water Birds N. Amer., I, 1884, p. 315.—RIDGWAY, Man. N. Amer. Birds, 1887, p. 171.

Range.—America in general, breeding in arctic and subarctic districts of the northern continent. Galapagos Archipelago: Albemarle Island (Baur and Adams);[2] "observed on Chatham Island" (Baur); Indefatigable Island (Habel).

NUMENIUS BOREALIS (Forster).

Scolopax borealis, FORSTER, Philos. Trans., LXII, 1772, pp. 411, 431.

Numenius borealis, LATHAM, Index Orn., II, 1790, p. 712.—SALVIN, Proc. Zool. Soc., 1883, p. 429 (Charles Island, Galapagos Archipelago).—BAIRD, BREWER and RIDGWAY, Water Birds N. Amer., I, 1884, p. 318.—RIDGWAY, Man. N. Amer. Birds, 1887, p. 171.

Range.—America in general, breeding in arctic districts of the northern continent. Casual in the Galapagos Archipelago: Charles Island (Markham).

Family RECURVIROSTRIDÆ.

Genus HIMANTOPUS, Brisson.

Himantopus, BRISSON, Orn., VI, 1760, p. 33. Type, *Charadrius himantopus*, Linnæus.

Range.—Warmer parts of both hemispheres. Galapagos Archipelago (one species, apparently identical with the species of North America, Middle America, and northern South America).

? HIMANTOPUS MEXICANUS (Müller).

Charadrius mexicanus, MÜLLER, Syst. Nat. Suppl., 1776, p. 117.

Himantopus mexicanus, ORD, ed. Wils. Orn., VII, 1824, p. 52.—BAIRD, BREWER, and RIDGWAY, Water Birds N. Amer., I, 1884, p. 345—RIDGWAY, Man. N. Amer. Birds, 1887, p. 147; Proc. U. S. Nat. Mus., XII, 1889, p. 116 (James Island, Galapagos Archipelago).

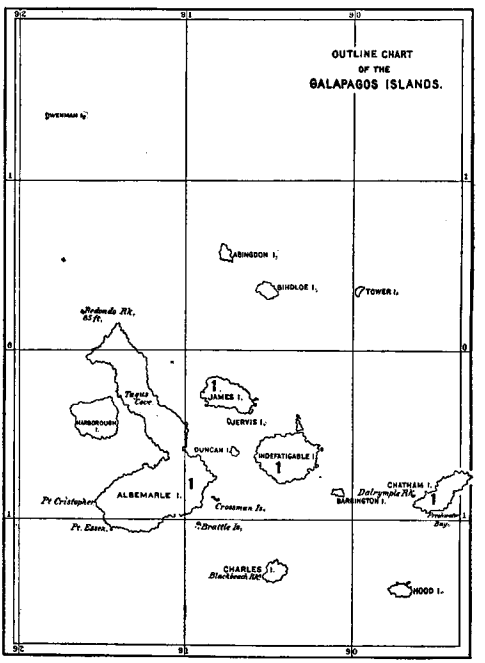
Himantopus nigricollis, VIEILLOT, Nouv. Dict., X, 1817, p. 42.—SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Indefatigable Island).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 502 (Indefatigable Island).

[1] Two specimens from "Albemarle" and one from "North Albemarle."

[2] Six specimens.

Range.—Temperate North America and southward to Brazil and Peru. Galapagos Archipelago: Albemarle Island[1] (Baur and Adams); Chatham Island[2] (Baur and Adams); Indefatigable Island (Habel); James Island (*Albatross*).

ASCERTAINED RANGE OF GENUS HIMANTOPUS, BRISSON, IN THE GALAPAGOS ARCHIPELAGO.



1. *Himantopus mexicanus* (Müller)?

I am unable to separate these Galapagos specimens from northern examples, or true *H. mexicanus*. The National Museum series of the latter is very meager, however. The two adult males show some black on some of the rectrices, in the form of roundish or ovate spots at the tip of the inner webs, one of them having, in addition, a dusky clouding on the outer web of two or three of the tail-feathers. All the adults are molting their primaries, in consequence of which their wing

[1] Two specimens. [2] Four specimens.

measurements could not be taken. Other measurements, however, are as follows:

Measurements of Himantopus mexicanus.

Number.	Sex and age.	Locality.	Date.	Tail.	Culmen.	Naked part of tibia.	Tarsus.	Middle toe.
83	Adult female	Chatham Island	June 19, 1891	2.70	2.63	2.52	4.08	1.61
85	Adult male	do	do	2.72	2.50	2.58	3.80	1.48
311	do	Albemarle Island	July 15, 1891	2.70	2.50	3.15	4.26	1.50
312	Adult female	do	do	2.50	2.42	2.35	3.70	1.52
		Average		2.66	2.51	2.65	3.96	1.52

Two of Messrs. Baur and Adams' specimens being immature, as are also both of those obtained by Mr. Townsend, their measurements are not given.

The following fresh color notes are found in Mr. Adams' note book, but whether they apply to adult or young birds is not stated. If the former, there seems to be considerable difference in color of the legs between Galapagos and North American specimens, which in the latter is (usually, at least) clear pink or rosy lilac.

Feet, tarsi, and one inch of tibia pinkish vinaceous, the other part of tibia vinaceous-cinnamon.

Family LARIDÆ.

Genus LARUS, Linnæus.

Larus, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 136. Type, by elimination, *L. canus*, Linnæus.

Range.—Cosmopolitan. Galapagos Archipelago (one peculiar species, related to species of the Pacific coast of North and South America).

LARUS FULIGINOSUS, Gould.

Larus fuliginosus, GOULD, Zool. Voy. Beagle, III, Birds, 1841, p. 141 (James Island, Galapagos Archipelago).—SCLATER and SALVIN, Proc. Zool. Soc., 1870, p. 323 (Indefatigable and Abingdon islands); 1871, p. 574.—SUNDEVALL, Proc. Zool. Soc., 1871, p. 125 (Charles and Indefatigable islands).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 505, pl. LXXXVII (Indefatigable, Abingdon, and Charles islands).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 116 (Indefatigable, James, and Chatham islands).

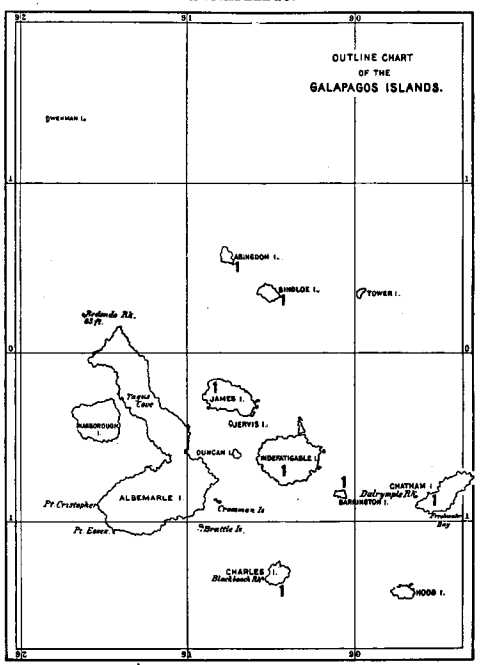
Specific characters.—Entire plumage deep grayish (adult) or sooty brown (young), the primaries blackish and the upper tail-coverts paler gray than back, etc.

Range.—Galapagos Archipelago: Charles Island (Kinberg); Chatham Island (Townsend, Baur and Adams); Barrington Island (Baur and Adams); Indefatigable Island (Kinberg, Habel, *Albatross*); James Island (Darwin, *Albatross*); Bindloe Island (Baur and Adams); Abingdon Island (Habel).

Adult male.—No. 116061, U.S.N.M.; Indefatigable Island, Galapagos, April 12, 1888; C. H. Townsend. Head and upper neck dark sooty

slate, paling anteriorly into brownish slate-gray, the posterior outline rather distinct, forming a fairly well-defined "hood;"[1] a longitudinal spot of white on each eyelid; lower neck, chest, and upper parts generally plain gray,[1] more or less stained, here and there, with brownish; secondaries passing into very pale gray or grayish white at tips; upper tail-coverts pale gray; under parts of body pale brownish gray, deeper

ASCERTAINED RANGE OF THE GENUS LARUS, LINNÆUS, IN THE GALAPAGOS ARCHIPELAGO.



1. *Larus fuliginosus*, Gould.

on sides and flanks, passing into very pale gray or grayish white on under tail-coverts. Six outermost primaries dull slate-black, the shorter ones tipped with a small gray spot; innermost primaries gray (like back, etc.), with very indistinct paler terminal margins; primary coverts intermediate in color between primaries and secondaries. Tail rather light brownish gray, becoming still paler on lateral feathers. Bill black; legs and feet brownish black (Adams, MS.). Length (skin),

[1] Corresponding most nearly with No. 6, pl. II, of my "Nomenclature of Colors."

18; wing, 13.65; tail, 5.65; exposed culmen, 1.68; greatest depth of bill, 0.50; least depth of bill, 0.50; tarsus, 2.30; middle toe, 1.75.

Adult female.[1]—No. 126001, U.S.N.M.; Chatham Island, Galapagos, March 30, 1891; C. H. Townsend. Similar to the adult male, as described above, but head, neck, and chest browner, with many feathers of the immature plumage intermingled with those of the adult livery; under parts darker and decidedly browner gray, the under tail-coverts not approaching grayish white; secondaries and innermost primaries much darker, the former approaching black and with very distinct and broad ash gray tips, the latter with a more or less distinct blackish subterminal spot; tail much darker gray, shaded or suffused on edges of feathers with blackish, crossed by a broad subterminal band of blackish (nearly disappearing on lateral feathers), and marked with more or less distinct terminal spots of gray. Length (skin), 16.75; wing, 13.25; tail, 5.50; exposed culmen, 1.62; greatest depth of bill, 0.50; least depth of bill, 0.48; tarsus, 2.18; middle toe, 1.55.

Immature (second year).—No. 116031, U.S.N.M.; James Island, Galapagos, April 11, 1888; C. H. Townsend. Head, neck, chest, and most of upper parts sooty grayish brown, the feathers of the mantle with paler margins; rump uniform grayish brown; upper tail-coverts light gray, marked with a rather indistinct terminal spot of brownish; secondaries dull blackish slate, with paler terminal margins; primaries black, inclining to blackish slate on innermost quills; tail slaty black, fading into slate-gray basally, especially on inner webs, the lateral feathers with more than basal half of inner web rather light gray; under parts deep sooty gray or grayish brown, laterally lighter brownish gray, clouded with a more decided brown hue medially, passing into uniform pale brownish gray on anal region; under tail-coverts brownish gray, passing into a decidedly paler hue on margins. Bill and feet as in adults. Length (skin), 16.80; wing, 13.35; tail, 5.50; exposed culmen, 1.60; greatest depth of bill, 0.48; least depth of bill, 0.44; tarsus, 2.22; middle toe, 1.62.

Measurements of Larus fuliginosus.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Exposed culmen.	Greatest depth of bill.	Least depth of bill.	Tarsus.	Middle toe
92	B. & A.	Adult female.	Chatham Island.	June 20, 1891	12.15	5.08	1.60	.50	.48	2.05	1.57
116	B. & A.	....do	....do	June 24, 1891	13.20	5.23	1.63	.50	.49	2.06	1.63
127	B. & A.	Adult male	....do	June 25, 1891	14.05	5.88	1.73	.55	.51	2.18	1.75
128	B. & A.	Juvenile female.	....do	....do	13.75	5.32	1.57	.51	.48	2.23	1.61
129	B. & A.	Adult female	....do	....do	13.50	5.48	1.62	.52	.50	2.02	1.60
130	B. & A.	Adult male	....do	....do	13.65	5.65	1.75	.53	.53	2.22	1.73
270	B. & A.	Adult female.	Barrington Island.	July 4, 1891	13.30	5.25	1.60	.55	.49	1.97	1.61
116061	U.S.	Adult male	Indefatigable Island.	Apr. 12, 1888	13.65	5.65	1.68	.50	.50	2.30	1.75
116062	U.S.	Adult	....do	....do	13.15	5.70	1.59	.49	.46	2.12	1.56
116031	U.S.	Juvenile	James Island	Apr. 11, 1888	13.35	5.50	1.60	.48	.44	2.22	1.62
126001	U.S.	Adult female	Chatham Island.	Mar. 30, 1891	13.25	5.50	1.62	.50	.48	2.18	1.55
			Average		13.36	5.51	1.64	.51	.49	2.25	1.63

[1]Not quite adult, the browner feathers belonging to the immature dress.

Genus CREAGRUS, Bonaparte.

Creagrus, BONAPARTE, Naumannia, 1854, p. 213. Type, *Larus furcatus*, Néboux.

Generic characters.—Bill with culmen longer than middle toe (nearly equal to tarsus), its tip strongly decurved and its depth greatest at base; tail nearly half as long as wing, forked for about one third its length. Adult with head and upper half of neck slate color, and exterior margin of scapular region bordered by a conspicuous white stripe.

Range.—Galapagos Archipelago, Malpelo Island, and (casually) coast of South America as far south as Paracas Bay, Peru.

This genus is exceedingly distinct from *Xema*, the few resemblances to which are purely superficial.

From *Xema*, the points of structural difference are many and decided. The bill is very peculiar in shape, being much deeper at the base than elsewhere and strongly decurved at the tip, that of *Xema* being much smaller proportionally, much straighter, and much deeper through the angle than at the base. The tail is relatively much longer and much more deeply forked, being nearly half as long as the wing and forked for about one-third of its length, while that of *Xema* is much less than half as long as the wing and forked for not more than one-eighth of its length. As to coloration, there is even greater difference, *Creagrus* having the dark "hood" descending much farther down over the neck, and instead of being very abruptly terminated by a black border has no very definite outline except on the fore neck; while the white patch at the base of the upper mandible and the very conspicuous white stripe margining the exterior scapulars are entirely peculiar features. Moreover, the plumage of the young is quite distinct in its character from that of *Xema*.

CREAGRUS FURCATUS (Néboux).

Mouette à queue fourche, NÉBOUX, Rev. Zool., 1840, p. 290.

Larus furcatus, NÉBOUX, Rev. Zool., 1840, p. 290; Voy. Vénus, Atlas, 1846, pl. x. ("Monterey, California;" Paris Museum).—PRÉVOST et DES MURS, Voy. Vénus, V, Ois., 1855, p. 277.

Creagrus furcatus, BONAPARTE, Naumannia, 1854, p. 213.—SALVIN, Trans. Zool. Soc., IX, Pt. IX. 1876, p. 506 (Dalrymple Rock, Chatham Island, Galapagos Archipelago).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p 117 (Dalrymple Rock).—TOWNSEND, Bull. Mus. Comp. Zool., XXVII, 1895, p. 125 (Malpelo Island).

Xema furcatus, BRUCH, Jour. für Orn., 1853, p. 103.

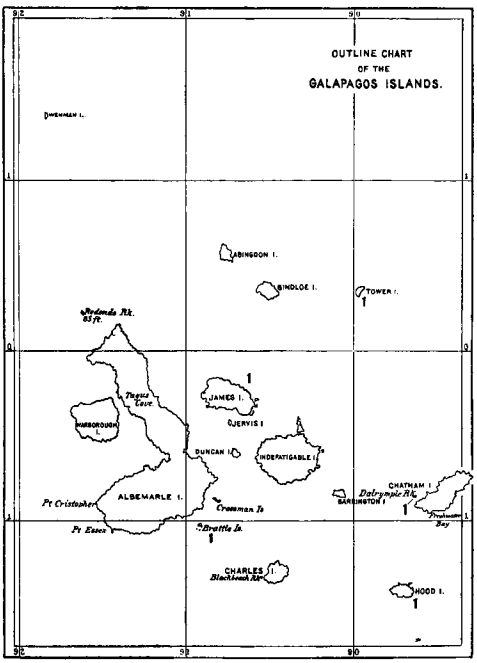
Xema furcatum, COUES, Key, 1872, p. 317.—SAUNDERS, Proc. Zool. Soc., 1878, p. 210 (Chatham Island); 1882, p. 523, pl. 34 (Paracas Bay, Peru).

Xema furcata, COUES, Check List, 2 ed., 1882, No 791.—BAIRD, BREWER and RIDGWAY, Water Birds N. Amer., II, 1884, p. 273.

Specific characters.—Adult with head and neck slate colored, with a white spot at base of maxilla and on chin, sometimes also a smaller spot at apex of malar feathering; above clear gray, with a white line

along the exterior margin of the scapular region; tail, under parts, secondaries, and outermost wing-coverts white. Bill black with whitish tip; legs and feet red. Young chiefly white, including head and neck, the latter with a brown or dusky spot behind ear-coverts and in front of eye; rectrices with a dusky subterminal spot; mantle grayish, spotted with black. Bill wholly dusky; legs and feet pale (flesh color

ASCERTAINED RANGE OF THE GENUS CREAGRUS, BONAPARTE, IN THE GALAPAGOS ARCHIPELAGO.



1. *Creagrus furcatus* (Néboux).

in life?). Length, about 20–22 inches; wing, 15.35–16.77; tail, 6.90–8.02, forked for about 2.45–3; culmen, 1.82–2.12; tarsus, 1.89–2.32; middle toe, 1.70–2.10.

Range.—Galapagos Archipelago: Brattle Island (Baur and Adams); Hood Island (Baur and Adams); Dalrymple Rock, Chatham Island (Kellett and Wood, *Albatross*); off James Island (Baur and Adams); Tower Island (Baur and Adams). Malpelo Island, off Gulf of Panama (Townsend). Casual (?) off coast of Peru (Paracas Bay, Markham), and off coast of southern California ("Monterey" Néboux).

Adult male (*breeding plumage*).—No. 115967, U.S.N.M.; Dalrymple Rock, Chatham Island, Galapagos, April 6, 1888; U. S. S. *Albatross.* A white patch at base of upper mandible, crossing anterior portion of forehead, and averaging about 0.35 of an inch in width;[1] a very small white spot on the apex of the malar region: rest of head with upper half of neck uniform slate color,[2] this rather abruptly terminated on the fore neck, but posteriorly fading gradually into the lighter gray of the hind neck; lower neck, all round, pale gray,[3] below extending over the sides of the breast, and fading gradually into the pure white of the middle of the breast and other under parts, but above gradually deepening into the uniform medium gray[4] which covers the back, scapulars, wing-coverts (except the lower greater and those along the margin of the wing), tertials, and rump; upper tail-coverts and tail entirely pure white, this abruptly contrasted with the deep gray of the rump. Exterior scapulars broadly and abruptly margined with pure white, forming a continuous and conspicuous narrow stripe along each side of the dorsal region; marginal wing-coverts, alulæ, lower greater coverts, and upper secondaries pure white; lower secondaries with outer webs very pale gray; four innermost primaries very pale gray, narrowly margined with white; sixth similar, but with a blackish blotch near the tip, extending quite across the inner web and for some distance along its edge; fifth quill mostly pale gray, with dusky shaft, the terminal portion (for about 1.30 inches along the shaft, black, this color much more extensive, however, along both edges), but with a small white apical spot; fourth quill with black much more extensive (extending nearly 5 inches from tip on outer web or 1.75 to nearest point on the inner), with still smaller white apical spot, the rest of the inner web white, becoming gray next to the shaft; third quill with black extending about 6.80 from the tip, or almost to the coverts on outer web, and 2 to nearest point on the inner, the white portion separated from the shaft by a dusky stripe; second quill similar, but with the whole exposed portion of outer web black, but the black on the inner web a little more restricted; first quill similar, but black near tip of inner web more restricted, though the stripe along the shaft is broader. (The three outermost quills have the white apical spots reduced to minute specks, which would entirely disappear with a very slight wearing of the feathers.) Bill black, with a little less than the terminal third (or for about 0.70 of an inch from the tip) yellowish horn white or pale olive-buff; rictus and broad tumid eyelids orange-red; iris dark brown; legs and feet deep red; claws deep black. Length (mounted specimen), about 20; wing, 16.25; tail, 7.40 (forked for 2.50); exposed culmen, 1.90; depth of bill at angle, 0.50, at base of culmen, 0.68; tarsus, 2; middle toe, 1.80.

[1] This white patch does not extend as far down as the edge of the mandible.

[2] Corresponding to the slate color (No. 4, pl. II) of my "Nomenclature of Colors," but slightly browner.

[3] Varying from tints 8–9, pl. II, of my "Nomenclature of Colors."

[4] Much like tint 7, pl. II, of my "Nomenclature of Colors."

Adult female (*breeding plumage*).—No. 115968, U.S.N.M., same locality, etc. Similar to the male, but with the slate-colored "hood" even less distinctly defined (approaching abrupt definition only on the fore neck), and white patch at base of upper mandible more restricted (averaging not more than 0.25 wide), the white spot on the malar apex also smaller (almost obsolete on one side). Length (mounted specimen), about 18; wing, 15.75; tail, 7.60 (forked for 2.60); exposed culmen, 1.90; depth of bill at angle, 0.47, at base of culmen, 0.65; tarsus, 1.98; middle toe, 1.70.

Mr. Adams' notes on fresh colors of the unfeathered parts are as follows:

Adult male.—Tip of beak pearl gray; basal portion brownish slate-black; iris seal brown (large pupil); eyelids coral red; tibiæ just below feathers washed with vermilion, most intense next feathers, and between toes at base of webs about same color; tarsi and toes rose pink; creases in webs dusky, the papillæ rose pink; nails brownish black, with a narrow grayish line on top; under surface of webs same color as upper; under surface of toes and heel orange-ochraceous (not showing on heel when foot is resting on flat surface); between scales on tarsi light ashy; webs most dusky at edges. Length, 22¾; extent, 4 feet 4½ inches.

Young female (September 2).—Legs and feet drab-gray, except posterior portion of tarsus, which is tinged with broccoli brown; iris dark brown; eyelids black; bill slate color.

A colored sketch made by Mr. Townsend from a freshly killed specimen taken at Malpelo Island, Gulf of Panama, March 5, 1891, agrees closely with Mr. Adams' description, but shows, as additional features, the rictus to be bright red, like the eyelids, while the naked skin on each side of the chin, next to the mandibular rami, is also red, but of a paler tint than the rictus and eyelids.

Measurements of Creagrus furcatus.

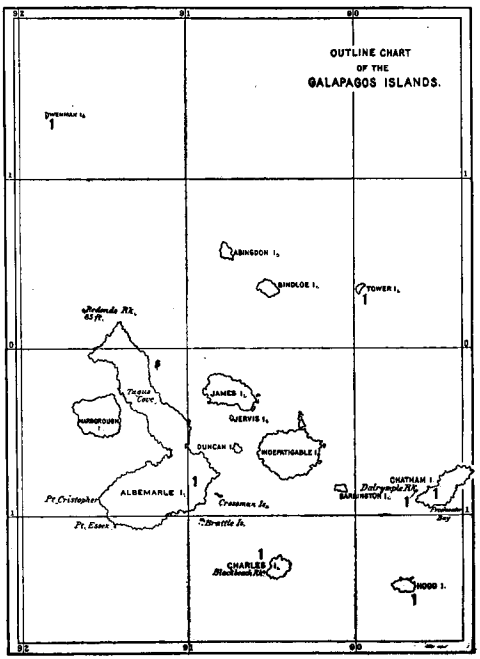
Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Fork of tail.	Exposed culmen.	Depth of bill at angle.	Depth of bill at base of culmen.	Tarsus.	Middle toe.
				1888.								
115967	U. S.	Adult male	Dalrymple Rock Galapagos.	Apr. 6	16.25	7.40	2.50	1.90	.50	.68	2.00	1.80
115968	U. S.	Adult female	do	do	15.75	7.60	2.60	1.90	.47	.65	1.98	1.70
				1891.								
131674	U. S.	Adult male	Malpelo Island	Mar. 5	16.50			2.05	.55	.65	2.32	1.95
131675	U. S.	Adult female	do	do	16.00	7.45	2.45	1.90	.50	.65	1.98	1.78
131676	U. S.	do	do	do	16.00	7.50	2.90	1.98	.51	.70	1.95	1.85
131677	U. S.	do	do	do	16.25	8.02	3.00	2.01	.55	.65	2.02	1.95
(a)	B. & A.	Adult male	Tower Island, Galapagos.	Sept. 3	16.25	6.90		2.00	.50	.73	2.00	2.00
(b)	B. & A.	do	Off James Island, Galapagos.	Aug. 21	16.65	7.73		2.00	.53	.69	2.21	2.06
2	B. & A.	do	Hood Island, Galapagos.	July 7		7.80		1.82	.50	.65	2.10	1.82
238	B. & A.	do	do	do		7.65		2.00	.49	.66	1.89	1.89
241	B. & A.	do	do	do	16.75	7.98		2.09	.50	.69	2.14	1.93
243	B. & A.	Adult female	do	do	16.00	7.30		1.90	.49	.62	2.00	1.95
245	B. & A.	Adult male	do	do	15.35	7.00		1.92	.53	.72	2.05	2.06
246	B. & A.	do	do	do	15.90	7.60		1.95	.56	.70	1.95	2.05
289	B. & A.	do	Brattle Island, Galapagos.	July 13	16.62	7.80		2.02	.49	.66	2.20	1.95
290	B. & A.	Adult female	do	do	16.30	7.18		2.00	.49	.61	1.95	1.80
291	B. & A.	Adult male	do	do	16.20	7.58		2.05	.53	.67	2.05	2.05
292	B. & A.	do	do	do	16.30	7.65		1.92	.51	.65	2.05	1.98
293	B. & A.	do	do	do	16.62	7.10		2.12	.55	.73	2.10	2.10
294	B. & A.	do	do	do	16.77	7.47		2.04	.54	.72	2.08	1.99
			Average		16.25	7.51	2.69	1.98	.51	.67	2.05	1.93

Genus ANOUS, Stephens.

Anous, STEPHENS, Shaw's Gen. Zool., XIII, Pt. 1, 1826, p. 139. Type, *Sterna stolida*, Linnæus.

Range.—Tropical seas in general. Galapagos Archipelago (one peculiar species).

ASCERTAINED RANGE OF THE GENUS ANOUS, STEPHENS, IN THE GALAPAGOS ARCHIPELAGO.



1. *Anous galapagensis*, Sharpe.

ANOUS GALAPAGENSIS, Sharpe.

Megalopterus stolidus (nec *Sterna stolida*, LINNÆUS), GOULD, Zool. Voy. Beagle, III, Birds, 1841, p. 145 (Galapagos Archipelago).

Anous stolidus, SUNDEVALL, Proc. Zool. Soc., 1871, p. 125 (Galapagos).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 504 (Dalrymple Rock, Chatham Island).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 116 (Dalrymple Rock).

Anous galapagensis, SHARPE, Philos. Trans., CLXVIII, 1879, p. 469.—SALVIN, Proc. Zool. Soc., 1883, p. 430 (Charles Island).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 116 (Hood and Chatham islands).

Specific characters.—Similar to *A. stolidus* (Linnæus), but much darker and less brown, the head and neck almost slate color, and the forehead, in most perfect plumage, mouse gray, slightly paler along the edge, adjoining the black lores. (Many specimens, apparently adults, have the forehead but little grayer than the occiput).

Range.—Galapagos Archipelago: Albemarle Island (Baur and Adams); Charles Island (Markham); Hood Island (*Albatross*, Baur and Adams); Chatham Island (Kellett and Wood, Townsend); Tower Island (Baur and Adams); Wenman Island (Townsend).

Adult male (*fresh plumage*).—No. 126004, U.S.N.M.; off Wenman Island, April 4, 1891; C. H. Townsend. Head, neck, and chest uniform deep brownish slate, becoming darker on the lores, especially along their upper margin and immediately in front of the eyes, where nearly black, lighter and grayer on pileum, where becoming gradually paler anteriorly, the whole forehead being uniform smoke gray, lighter, approaching grayish white, in a narrow line along the lateral edge, next to the blackish anteorbital patch; a small white spot a little posterior to the middle of the upper eyelid and lower eyelid white for nearly its whole length, the space between the posterior extremity of the latter and the white spot on upper eyelid black. Rest of the plumage, in general, uniform deep sooty slate-brown, browner on wing-coverts and middle under parts, more slaty on back, rump, and upper tail-coverts; remiges sooty black; primary coverts and rectrices more blackish slate. Bill entirely deep black; legs and feet brownish black. Length (skin), 15.25; wing, 11.10; tail, 6, graduated for 2; culmen, 1.57; depth of bill at base of culmen, 0.41; tarsus, 0.95; middle toe, 1.18.

Adult female (*fresh plumage*).—No. 115970, U.S.N.M.; Dalrymple Rock, Chatham Island, April 5, 1888; C. H. Townsend. Exactly like the adult male in plumage. Length (skin), 15.75; wing, 10.80; tail, 6.05, graduated for 1.70; culmen, 1.61; depth of bill at base of culmen, 0.41; tarsus, 0.98; middle toe, 1.20.

Adult male (*previous to molting.*)—No. 116091; U.S.N.M.; Hood Island, April 7, 1888; C. H. Townsend. Similar to the fully adult, as described above, but rather darker above and browner beneath, the pileum dark sooty slate, approaching a decided gray only along the lateral margin, adjoining the black loral space. Length (skin), 14.50; wing (primaries molting); tail, 5.92, graduated for 2; culmen, 1.53; depth of bill at base of culmen, 0.39; tarsus, 0.93; middle toe, 1.15.

Adult female (*before molting*).—No. 126003, U.S.N.M.; Wenman Island, April 4, 1891; C. H. Townsend. Similar to the male in same condition of plumage. Length (skin), 15; wing, 10.; tail, 5.75, graduated for 2; culmen, 1.46; depth of bill at base of culmen, 0.39; tarsus, 0.98; middle toe, 1.20.

While very distinct from *A. stolidus* (Linnæus), the character upon which the separation from that species of *A. galapagensis* was based ("crown of head uniform brown like the rest of the upper surface")

applies only to immature birds or adults just before the molt takes place, the fully adult birds, at least those in fresh plumage, having the pileum distinctly gray, though many shades darker than in *A. stolidus*, the color being a clear brownish slate-gray or smoke gray, changing rather abruptly to a hoary hue next to the upper margin of the black lores, where forming a rather distinct though narrow line. The color of the body, wings, and tail, however, is very different from that of *A. stolidus*, being dark sooty slate, instead of much lighter sooty brown; in fact, the general color of the plumage is exactly the same as in *A. leucocapillus*, Gould,[1] except that the tail and its coverts are nearly or quite concolor with the other parts, instead of having a more or less distinct grayish cast.

The "*Anous stolidus*" from Chatham Island mentioned in my paper[2] on the *Albatross* collection is not that species, but the fresh-plumaged adult of *A. galapagensis*. The erroneous identification was made not by comparison with *A. stolidus*, but with dusky crowned specimens corresponding with those described by Mr. Sharpe.

Measurements of Anous galapagensis.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Exposed culmen.	Depth of bill at base.	Tarsus.	Middle toe.
115970	U. S.	Adult female	Chatham Island	Apr. 5, 1888	10.80	6.05	1.61	0.41	0.98	1.20
115971	U. S.	do	do	do	10.00	5.28	1.53	.38	.96	1.18
116091	U. S.	Adult male	Hood Island	Apr. 7, 1888	.....	5.92	1.53	.39	.93	1.15
126003	U. S.	Adult female	Wenman Island	Apr. 4, 1888	10.00	5.75	1.46	.39	.98	1.20
126004	U. S.	Adult male	do	do	11.10	6.00	1.57	.41	.95	1.18
242	B. & A.	do	Hood Island	July 7, 1891	11.00	5.90	1.70	.41	.96	1.22
406	B. & A.	do	Albemarle Island	July 31, 1891	10.90	6.10	1.60	.36	.94	1.25
407	B. & A.	do	do	do	11.18	6.00	1.50	.40	.90	1.18
408	B. & A.	do	do	Aug. 1, 1891	10.40	5.68	1.53	.38	.86	1.20
409	B. & A.	do	do	do	10.42	5.58	1.52	.35	.82	1.22
410	B. & A.	do	do	do	10.70	5.70	1.67	.38	.95	1.17
411	B. & A.	do	do	do	10.53	5.55	1.58	.38	.86	1.18
412	B. & A.	do	do	do	10.80	6.10	1.58	.40	.96	1.23
	B. & A.	Adult female	Tower Island	Sept. 4, 1891	10.30	5.80	1.51	.38	.83	1.14
	B. & A.	Adult female†	do	Aug. 3, 1891	9.65	5.00	1.40	.32	.87	1.18
	B. & A.	Adult male	do	Sept. 4, 1891	10.70	5.70	1.54	.37	.94	1.36
	B. & A.	do	do	do	10.00	5.82	1.51	.38	.91	1.22
	B. & A.	do	do	do	10.45	6.00	1.58	.41	.93	1.25
			Average		10.51	5.77	1.55	.39	.91	1.21

[1] *Anous leucocapillus*, GOULD, Proc. Zool. Soc., 1845, p. 103 (Raines Island, Australia).—STONE, Proc. Acad. Nat. Sci. Phila., 1894, pp. 116, 117 (critical).

† *Anous melanogenys*, GRAY, Gen. Birds, III, 1849, p. 661, pl. 182.

Anous melanogenys, SAUNDERS, Proc. Zool. Soc., 1876, p. 670, pl. LXI, fig. 2.—BAIRD, BREWER, and RIDGWAY, Water Birds N. Amer., II, 1884, p. 324.—RIDGWAY, Man. N. Amer. Birds, 1887, p. 49.

Anous tenuirostris (nec *Sterna tenuirostris*, TEMMINCK), SCLATER and SALVIN, Proc. Zool. Soc., 1871, p. 566.—COUES, Birds N.-W., 1874, p. 710, footnote.

[2] Proc. U. S. Nat. Mus., XII, p. 116.

Measurements of Anous stolidus (Linnæus).

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Exposed culmen.	Depth of bill at base.	Tarsus.	Middle toe.	Graduation of tail.
2008	U. S.	Adult	Florida		10.30	5.22	1.61		0.98	1.13	1.60
8685	U. S.	Adult female	Tortugas, Florida.	June 26, 1857	10.30	5.35	1.58	.40			1.75
33697	U. S.	do	British Honduras.	May 12, 1862	10.50	5.93	1.72	.39	1.00	1.20	1.78
80018	U. S.	Adult	Dominica, West Indies.				1.45	.38	1.02	1.25	
80910	U. S.	do	St. Lucia, West Indies.		10.30	5.48	1.70	.46	.98	1.20	1.70
84854	U. S.	Adult male	Grenada, West Indies.	May 10, 1881	10.25	5.75	1.73	.41	1.00	1.20	1.80
109050	U. S.	Adult	Guadeloupe, West Indies.		10.00	5.57	1.68	.46	1.00	1.20	1.70
121113	U. S.	do	150 miles off mouth of Amazon.		9.90	5.48	1.60	.37	.98	1.15	1.70
12582	U. S.	Adult male	Atlantic Ocean, lat. 0°, long. 17° 44′.		10.30	5.82	1.62	.41			1.85
97893	U. S.	Adult	Caribbean Sea		10.55	5.72	1.72	.40	1.08	1.18	1.98
			Average		10.29	5.60	1.64	.40	1.01	1.19	1.76

Measurements of Anous stolidus rousseaui (Hartlaub[1]*).*

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Exposed culmen.	Depth of bill at base of culmen.	Tarsus.	Middle toe.	Graduation of tail.
131694	U. S.	Adult	Cocos Island	Feb. 28, 1891	11.40	6.60	1.61	0.41	1.03	1.24	2.30
131695	U. S.	do	do	do	10.95	6.23	1.58	.43	1.03	1.25	2.20
131696	U. S.	Adult male	do	do	10.90	6.48	1.62	.42	1.00	1.27	2.40
131697	U. S.	do	do	do	11.35	6.60	1.68	.43	1.09	1.28	2.28
			Average		11.15	6.43	1.62	.42	1.04	1.26	2.30
58786	U. S.	do	Isabella Island, west Mexico.	Apr. 27, 1869	10.30	5.88	1.62	.42	1.00	1.18	2.00
58791	U. S.	Adult female	do	do	10.50	6.02	1.62	.40	1.01	1.15	2.10
15517	U. S.	Adult	Belinghausen Island, Pacific Ocean.		11.20	6.25	1.60	.42	1.00	1.23	2.50
15526	U. S.	Adult male	Waralea Island, Pacific Ocean.		11.20	6.60	1.75	.41	1.03	1.30	2.35
67326	U. S.	Adult	West of Sandwich Islands, Pacific Ocean.		10.40	5.92	1.47	.38	1.00		2.15
			Average		10.72	6.13	1.61	.41	1.01	1.22	2.22
119796	U. S.	Adult female	Seychelles	Apr. 3, 1890			1.63	.40	.98	1.20	2.20
119798	U. S.	Adult male	do	do	10.60	5.82	1.71		1.03	1.20	2.50
128750	U. S.	do	300 miles southwest of Seychelles.	Aug. 14, 1892	10.70	6.35	1.68	.42	1.10	1.25	2.10
128751	U. S.	do	Northwest of Madagascar.	Oct. 15, 1892	11.00	5.80	1.68	.42	1.00	1.23	1.85
			Average		10.76	5.99	1.68	.41	1.03	1.22	2.16

[1] *Anous rousseaui*, HARTLAUB, Beitr. Orn. Madagasc., 1860, p. 86 (Madagascar; collection Paris Museum; = young).

Anous frater, COUES, Proc. Acad. Nat. Sci. Phila., December, 1862, p. 558 (Island of Kuralea, South Pacific; U. S. Nat. Mus.).

Not being aware that both Dr. Hartlaub and Dr. Coues had already separated the

Family DIOMEDEIDÆ.

Genus DIOMEDEA, Linnæus.

Diomedea, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 132. Type, *D. exulans*, Linnæus.

Range.—Southern seas and Pacific Ocean in general. Galapagos Islands (two widely ranging species).

? DIOMEDEA EXULANS, Linnæus.

Diomedea exulans, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 132.—"WOLF, Besuch aus den Galáp. Iseln, 1879, p. (269) 13" (Hood Island, Galapagos Archipelago).—BAIRD, BREWER, and RIDGWAY, Water Birds N. Amer., II, 1884, p. 347.—RIDGWAY, Man. N. Amer. Birds, 1887, p. 51.

Range.—Southern seas in general, north, casually, to Florida (Tampa Bay and mouth of St. Johns River) and Washington. Galapagos Archipelago (Hood Island, Wolf).

No specimens having been preserved, the identification of this species is doubtful. Indeed, only Habel and Wolf have recorded the occurrence among the Galapagos Islands of birds undoubtedly belonging to this genus. The former saw at Hood Island "two kinds of albatrosses. One had a dark blackish breast and a white band crossing the head from one eye to the other [*D. nigripes*, Audubon?]; the breast of the other was gray, and the head black."[1] The latter may have been an immature *D. exulans*. According to Wolf the last-named species was at one time very abundant on Hood Island. He says:

> I would mention as a curious zoological fact that the albatross of this island (Hood), and only this, occurs in such abundance that the entire camp of Orchilla collectors (more than 60 men) lived for a month chiefly upon its eggs, although each female lays but one egg. It is evidently the widespread albatross from the Cape of Good Hope (*Diomedea exulans*), which is also very abundant about Cape Horn.[2]

Noddy of the Pacific and Indian oceans from that of the Atlantic, I was surprised to find them really different. The differences of measurements and proportions pointed out by Dr. Coues (loc. cit.) hold good in a very much larger series of specimens than that which he examined, the pileum being decidedly darker and the general coloration darker and less brown in specimens from the Pacific and Indian oceans than in those from the Atlantic (true *A. stolidus*), the tail decidedly longer and more graduated, etc. It is probable, however, that still further subdivision will be necessary when a larger number of specimens have been compared. For example, specimens from Cocos Island, off Panama Bay, are darker and less brown than those from the Seychelles (true *A. rousseaui?*), being, in fact, nearly intermediate between the latter and the Galapagos form (*A. galapagensis*).

It is very likely an earlier name, based upon the bird from some part of the Pacific or Indian oceans, may be found. *Sterna philippina*, Latham (Index Ornithologicus, II, 1790, p. 805), cited by Blasius (Journ. für Orn., 1866, p. 83) as a synonym of *A. stolidus*, seems, however, scarcely applicable.

[1] See Trans. Zool. Soc. London, IX, Pt. IX, 1876, pp. 458, 459.

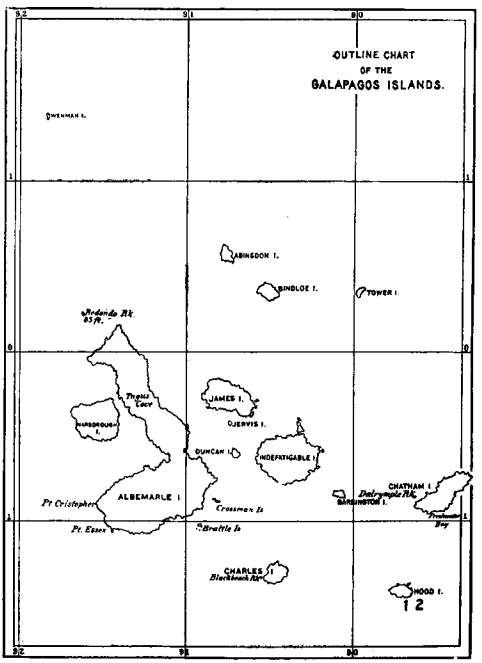
[2] Besuch aus den Galápagos Inseln, 1879, p. (269) 13.

? DIOMEDEA NIGRIPES, Audubon.

Diomedea nigripes, Audubon, Orn. Biog., V, 1839, p. 327 (eastern Pacific, lat. 50° N.; U. S. Nat. Mus.).—CASSIN, Illustr. Birds Cal. Tex., etc., 1853, p. 210, pl. 35.—BAIRD, BREWER and RIDGWAY, Water Birds N. Amer., II, 1884, p. 355.—RIDGWAY, Man. N. Amer. Birds, 1887, p. 51.

Range.—North Pacific Ocean, especially the eastern side. ? Casual in the Galapagos Archipelago (Hood Island, Habel).

ASCERTAINED RANGE OF THE GENUS DIOMEDEA, LINNÆUS, IN THE GALAPAGOS ARCHIPELAGO.



1. *Diomedea exulans*, Linnæus?.
2. *Diomedea nigripes*, Audubon?.

This is very likely the species seen by Dr. Habel which "had a dark blackish breast and a white band crossing the head from one eye to the other," *D. nigripes* being of a uniform deep sooty brown with the fore part of the head whitish.

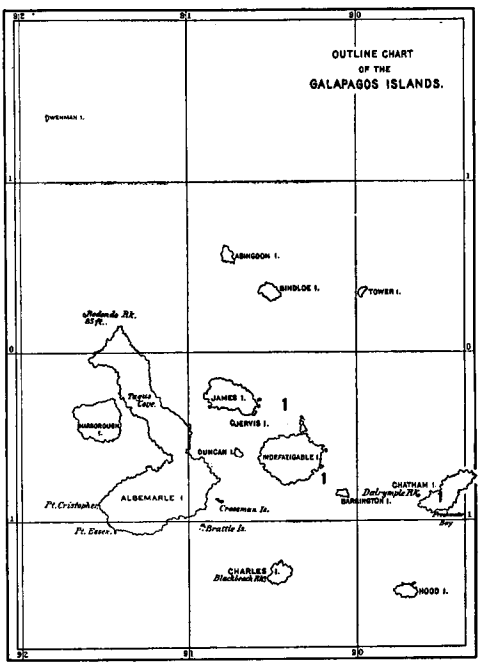
Family PROCELLARIIDÆ.

Genus AESTRELATA, Bonaparte.

Aestrelata, BONAPARTE, Consp. Av., II 1856, p. 188. Type, *Procellaria hasitata*, Kuhl.

Range.—Cosmopolitan (pelagic). Galapagos Archipelago (one species, most nearly related to, possibly identical with, a Hawaiian one).

ASCERTAINED RANGE OF THE GENUS AESTRELATA, BONAPARTE, IN THE GALAPAGOS ARCHIPELAGO.



1. *Aestrelata phæopygia*, Salvin.

AESTRELATA PHÆOPYGIA, Salvin.

Æstrelata phæopygia, SALVIN, Trans. Zool. Soc. Lond., IX, Pt. IX, May, 1876, p. 507, pl. LXXXVIII, figs. 1, 3 (Chatham Island, Galapagos Archipelago; collection Brit. Mus.).

Æstrelata phæopygia, RIDGWAY, Man. N. Amer. Birds, 1887, p. 65.

? *Œ.[strelata] sandwichensis*, RIDGWAY, in Baird, Brewer, and Ridgway's Water Birds N. Amer., II, 1884, p. 395, in text (Sandwich Islands; collection U. S. Nat. Mus.).

? *Æstrelata sandwichensis*, RIDGWAY, Proc. U. S. Nat. Mus., IX, 1886, p. 95; XI, 1888, p. 104.

Specific characters.—Axillars and under wing-coverts mostly white; above, including hind part and sides of head and neck and upper tail-coverts, dark brownish slate, darker on wings and tail, nearly black on head; feathers of neck and upper tail-coverts (the latter very abruptly) white beneath the surface; forehead, lores, cheeks, and entire under parts white, the sides and longer under tail-coverts sometimes irregularly barred with dusky. Wing, 11.50–12.25; tail, 5.01–5.47; culmen, 1.20–1.36, from nasal tubes, 0.90–1; depth of maxilla at base, 0.55–0.70; tarsus, 1.40–1.55; middle toe (without claw), 1.70–1.78.

Range.—Galapagos Archipelago: Chatham Island (Kellett and Wood); "off pass between Indefatigable and James" islands (Baur and Adams); "between Barrington and Indefatigable" islands (Baur and Adams). Sandwich Islands??.

The six examples of this species in Messrs. Baur and Adams' collection present among themselves some very noticeable though slight variations of plumage, these variations occurring in birds of the same sex and obtained the same date. In one female the back and scapulars are nearly uniform, though the tips of the feathers (broadly) are more of a grayish cast than the central (mostly concealed) portion; but there is not the slightest indication of the narrow grayish white tips seen to a greater or less extent in all the others, these being particularly well developed in another female, in which the whole dorsal region shows, besides these narrow whitish tips, a distinct ashy wash. In four of the six specimens the dusky color of the opposite sides of the lower neck is well separated by the immaculate pure white of the chest and lower fore neck; in one of the other two the dark color encroaches considerably on the sides of the chest, and even the front portion of the latter has a few very indistinct irregular transverse bars of grayish; while in the remaining example these markings are much more distinct, partaking of the character of quite regular bars, extending quite across the median portion of the chest. There is also some variation in the white on the basal portion of the inner webs of the primaries, which in some specimens is more distinctly contrasted with the adjacent dusky color than in others, but its extent is essentially the same in all.

According to Mr. Salvin,[1] my *Aestrelata sandwichensis* is the same as *A. phæopygia*. They certainly are much alike, and may be identical. But I am unable to match the type of the former among the six examples of the latter with which it has been carefully compared and from all of which it differs in the following particulars:

A. sandwichensis: Bill smaller (culmen from base of nasal tube 1.20, from anterior end of same 0.90), and nasal tubes shorter (0.30); hind neck and sides of neck light sooty slate, like back; feathers of back and scapulars without paler tips; inner webs of primaries without any definite white space, though basal portion is whitish.

A. phæopygia: Bill larger (culmen from base of nasal tube 1.30–

[1] See Proc. U. S. Nat. Mus., XI, 1888, p. 104.

1.36, from anterior end of same 0.92–1), and nasal tubes longer (0.33–0.38); hind neck and sides of neck black, like top of head; feathers of back and scapulars (especially the latter) with distinct narrow grayish white tips; inner webs of primaries with an extensive definite space of white, occupying (except on the first) at least the basal half.

It may be, of course, that a larger series, especially of the Sandwich Island bird, would show that these differences are inconstant; but until this has been demonstrated it seems best to regard *A. sandwichensis* as distinct, or at least to relegate it doubtfully to the synonymy of *A. phœopygia*.

Measurements of Aestrelata phœopygia.

Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Culmen from nasal tubes.	Depth of upper mandible at base.	Tarsus.	Middle toe.
Adult female	Between James and Indefatigable islands.	Aug. 21, 1891	11.50	5.47	1.30	0.90	.65	1.43	1.75
Adult male	do	Aug. 22, 1891	12.25	5.01	1.31	.98	.69	1.40	1.73
Adult female	do	do	11.75	5.02	1.36	1.00	.55	1.55	1.76
Do	do	do	11.56	5.38	1.30	.95	.70	1.41	1.70
Adult male	Between Indefatigable and Barrington islands.	July 11, 1891	12.00	5.42	1.35	1.00	.58	1.47	1.78
Adult female	do	do	11.75	5.30	1.30	1.00	58	1.48	1.72
	Average		11.80	5.27	1.32	.97	.62+	1.46	1.74

Measurements of type of Aestrelata sandwichensis.

Number.	Collection.	Sex and age.	Locality.	Wing.	Tail.	Culmen.	Culmen from nasal tubes.	Depth of upper mandible at base.	Tarsus.	Middle toe.
61258	U. S.	Adult	Sandwich Islands	11.70	5.80	1.22	0.90	0.57	1.35	1.55

Genus PUFFINUS, Brisson.

Puffinus, BRISSON, Orn., VI, 1760, p. 131. Type, *Procellaria puffinus*, Brünnich.

Range.—Cosmopolitan (pelagic). Galapagos Archipelago (one peculiar species).

PUFFINUS SUBALARIS, Townsend, MS.

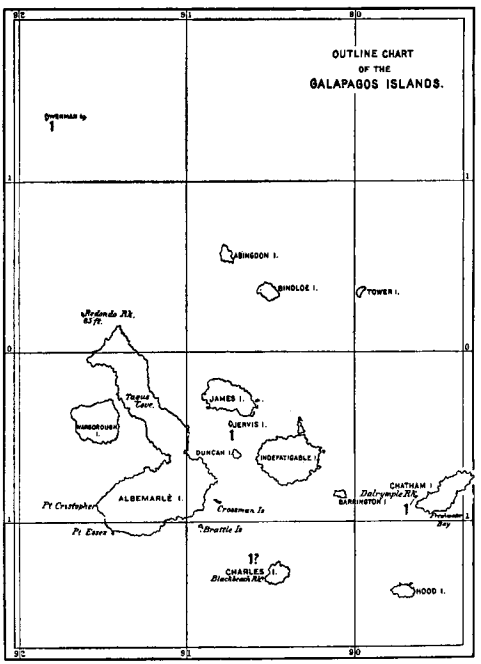
"*Puffinus tenebrosus*, PELZ.?" (nec PELZELN), TOWNSEND, Proc. U. S. Nat. Mus., XIII, 1890, p. 142 (Chatham Island, Galapagos Archipelago); Bull. Mus. Comp. Zool., XXVII, 1895, p. 126 (Chatham and Wenman islands).

Puffinus obscurus, (nec *Procellaria obscura*, GMELIN?), SALVIN, Proc. Zool. Soc., 1883, p. 431 (Charles Island, Galapagos).

Specific characters.—Similar to *P. audubuni*, Finsch,[1] but decidedly smaller and with under wing-coverts conspicuously clouded with brownish gray; under tail-coverts darker.

Range.—Galapagos Archipelago: ? Charles Island (Markham); Dalrymple Rock, Chatham Island (Townsend); Kicker Rock and Jervis Island (Baur and Adams); Wenman Island (Townsend).

ASCERTAINED RANGE OF THE GENUS PUFFINUS, BRISSON, IN THE GALAPAGOS ARCHIPELAGO.



1. *Puffinus subalaris*, Townsend.

Adult male.—Type, No. 117472, U.S.N.M.; Dalrymple Rock, Chatham Island, Galapagos, April 6, 1888; C. H. Townsend. Upper portion of

[1] *Puffinus audubuni*, FINSCH, Proc. Zool. Soc., 1872, p. 111 (Cape Florida; Berlin Mus.).—RIDGWAY, in Baird, Brewer & Ridgway's Water Birds N. Amer., II, 1884, p. 386; Man. N. Amer. Birds, 1887, p. 60.—AMERICAN ORNITHOLOGISTS' UNION, Check List, 1886, No. 92.

Puffinus obscurus (nec *Procellaria obscura*, GMELIN), AUDUBON, Synop. 1839, p. 339.—LAWRENCE, in Baird's Birds N. Amer., 1858, p. 835.—COUES, Proc. Acad. Nat. Sci. Phila., 1864, p. 137.

head, including a little more than upper half of lores and auricular region, dull slate color, deepening into blackish slate on occiput and hind neck, and this into sooty black on rest of upper parts, some of the feathers of the mantle having very indistinct paler terminal margins. A small spot above posterior portion of lores (continued in a narrow streak over eye to its posterior angle), a crescentic spot on lower eyelid (continued narrowly above upper margin of ear coverts), dull white; lower portion of lores, entire side of head beneath ear-coverts, sides of neck and chest, and entire lower parts, except under tail-coverts and flank feathers, uniform pure white, this almost abruptly defined against the dusky color of the hind neck; that on the sides of the head, including about the lower half of the auricular region, and separated from the white space on lower eyelid only by a very narrow line of grayish dusky. Flank feathers with whole upper webs (except concealed bases) and terminal portion of lower webs sooty grayish with indistinct grayish white terminal margins. Under tail-coverts uniform dark sooty, except median anterior feathers, which are sooty grayish at tips, white basally. Under wing-coverts mainly white, but this mostly covered by a clouding of brownish gray, the feathers of this color having whitish terminal margins. Inner webs of primaries grayish dusky passing through sooty grayish into grayish white at the base. Bill (in dried skin) dusky horn color; tarsi with inner side wholly light colored, outer side dusky below and along posterior margin, otherwise brownish; outer side of outer toe dusky, the inner side and all the rest of the foot (including webs) light colored.[1] Total length (skin), 10.50; wing, 7.45; tail, 2.95, lateral feathers, 0.60 shorter: culmen, 1.10, from nasal tubes, 0.82: depth of bill just anterior to nostrils, 0.22; tarsus, 1.37; middle toe (without claw), 1.41.

Adult female.—No. 132728, U.S.N.M.; Galapagos Islands, March 28, 1891; C. H. Townsend. Exactly like the male, as described above. Length (skin), 10.80; wing, 7.35; tail, 2.85, lateral feathers, 0.60 shorter; culmen, 1.08, from nasal tubes, 0.80; depth of bill in front of nostrils, 0.25; tarsus, 1.38: middle toe (without claw), 1.39.

This well-marked species differs from *P. audubonì* in smaller size, more slender bill, much more extensively and distinctly dusky under tail-coverts, greater amount of dusky on the flanks, less purely white under wing-coverts, and particularly, as to coloration, by the greater extent and sharper definition of the dusky on the side of the head, a

[1] Mr. Adams' notes on the fresh colors of an adult female are as follows: "Upper mandible and tip of beak blackish slate, other parts of under mandible bluish gray (No. 8, Ridgway's Nomenclature of Colors); outer side of tarsus and outer toe black, other parts a little more pinkish than pearl blue."

Of another specimen (sex not given) he notes as follows: "Inner side of tarsus with a little mottling of blue and pink added to pearl gray; outer upper portion of tarsus with purple added; lower side of tarsus and outer toe brownish black; webs with a little yellow (naples) added to pearl gray; middle toe more bluish than webs, but inner toe with only a trace more blue than web. Upper mandible, except lower basal portion, slate black (also tip of lower); rest of bill french gray."

distinct band of this color extending from the lores beneath the eyes and across the ear-coverts to the occiput, the lower edge of this dusky color strongly and quite regularly defined against the white below it.

From *P. auricularis*, Townsend,[1] of Clarion Island (Reville-Gigedo group), the present species differs in being much smaller (*P. auricularis* being still larger than *P. auduboni*), in having the lower portion of the lores (almost the lower half) white, in the presence of a whitish spot above the anterior angle of the eye, dusky feathers on the flanks, and grayish clouding of the under wing-coverts—these characters, except the last, being possessed in common with *P. auduboni*.

From what I take to be *P. obscurus*, Gmelin, of which there are three examples from the Seychelles now before me, the Galapagos species differs conspicuously in the absence of the extensive patch of sooty gray (feathers with white terminal margins) covering the sides of the neck and chest, the region so marked in *P. obscurus* (*?*) being wholly pure white in *P. subalaris*. The Seychelles bird also has the lores wholly dusky, and lacks the small whitish spot above the anterior angle of the eye. Otherwise the two birds are much alike.

Measurements of Puffinus subalaris.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Culmen from nostrils.	Depth of bill in front of nostrils.	Tarsus.	Middle toe (without claw).
				1888.							
117142	U. S. N. M.	Adult male	Dalrymple Rock	Apr. 6	7.45	2.95	1.10	0.82	0.22	1.37	1.41
132726	U. S. N. M.	do	do	do	7.50	2.80	1.10	.80	.23	1.50	1.40
				1891.							
132727	U. S. N. M.	Adult female	Wenman Island	Apr. 4	7.88	2.95	1.15	.83	.25	1.45	1.48
132728	U. S. N. M.	do	Galapagos	Mar. 28	7.35	2.85	1.08	.80	.25	1.38	1.39
	B. & A.	do	Kicker Rock	Aug. 24	7.05	2.65	1.03	.84	.21	1.49	1.49
	B. & A.	do	do	do	7.20	2.80	1.04	.80	.22	1.33	1.45
487	B. & A.	Adult male	Jervis Island	Aug. 9	7.31	2.60	1.08	.85	.23	1.38	1.42
488	B. & A.	do	do	do	7.45	2.60	1.00	.80	.21	1.30	1.45
490	B. & A.	Adult female	do	do	7.00	2.60	1.05	.81	.22	1.30	1.45
491	B. & A.	do	do	do	7.32	2.65	1.05	.82	.21	1.31	1.40
493	B. & A.	do	do	do	7.25	2.65	1.01	.78	.22	1.39	1.47
494	B. & A.	Adult male	do	do	7.40	2.51	1.08	.80	.24	1.46	1.40
497	B. & A.	Adult female	do	do	7.20	2.70	1.09	.85	.21	1.32	1.38
			Average		7.33	2.72	1.06	.82	.22	1.44	1.46

Genus OCEANODROMA, Reichenbach.

Oceanodroma, REICHENBACH, Syst. Av., 1852, p. iv. Type, *Procellaria furcata*, Gmelin.

Range.—Cosmopolitan (pelagic). Galapagos Archipelago (one species, found also in the Hawaiian group).

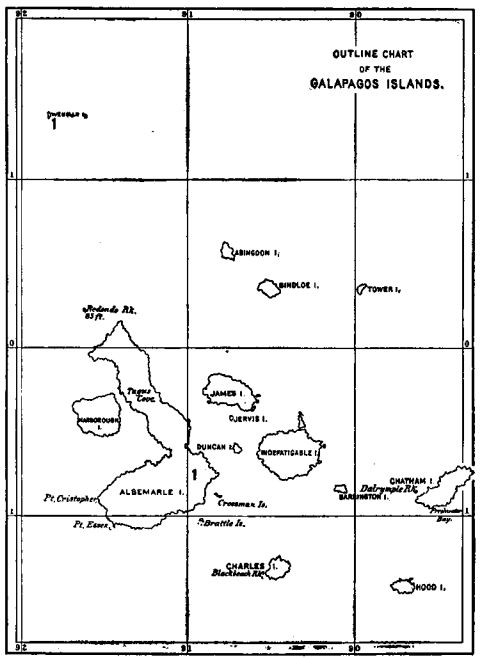
[1] *Puffinus auricularis*, TOWNSEND, Proc. U. S. Nat. Mus., XIII, 1890, p. 133 (Clarion Island, off west coast of Mexico; U. S. Nat. Mus.).

OCEANODROMA CRYPTOLEUCURA, Ridgway.

Cymochorea cryptoleucura, RIDGWAY, Proc. U. S. Nat. Mus., IV, March 29, 1882, p. 337 (Waimea Kaui, Sandwich Islands; U. S. Nat. Mus.); in Baird, Brewer & Ridgway's Water Birds N. Amer., II, 1884, p. 406.

Oceanodroma cryptoleucura, RIDGWAY, Man. N. Amer. Birds, 1887, p. 71.—TOWNSEND, Bull. Mus. Comp. Zool., XXVII, 1895, p. 125 (Wenman Island, Galapagos; "*cryptoleucnera*").

ASCERTAINED RANGE OF THE GENUS OCEANODROMA, REICHENBACH, IN THE GALAPAGOS ARCHIPELAGO.



1.—*Oceanodroma cryptoleucura*, Ridgway.

(Also, "off Albemarle Island," Townsend.)

Specific characters.—Similar to *O. leucorhoa*, Vieillot, but tail shorter and much less forked, tarsus shorter, longer upper tail-coverts broadly tipped with black, and tail feathers extensively white basally. Wing, 5.75–6.35; tail, 2.75–3, forked for 0.15–0.30; culmen, 0.55–0.61; tarsus, 0.80–0.92; middle toe, 0.77–0.90.

Range.—Hawaiian Archipelago; Galapagos Archipelago: Wenman Island and off Albemarle Island (Townsend).

Adult male.—No. 132763, U. S. N. M.; Wenman Island, Galapagos, April 4, 1891; C. H. Townsend. Above uniform very dark sooty, with a faint greenish slaty gloss in some lights; greater wing-coverts broccoli brown, producing an oblique band across the wing; remiges and primary coverts dull black; upper tail-coverts white, the longer ones abruptly tipped with black; tail black, with the concealed basal portion of the four outermost rectrices white, this most extensive on the lateral pair, where partly exposed beyond the coverts. Under parts deep sooty grayish brown (much lighter than upper parts), the sides of the crissum and the lateral under tail-coverts (also basal portion of longer median ones) white. Bill, legs, and feet wholly black. Length (skin), 7.20; wing, 5.85; tail, 2.80, forked for 0.15; culmen, 0.61; nasal tubes, 0.30; depth of bill in front of nostrils, 0.20; tarsus, 0.88; middle toe, 0.85.

This species, while bearing a superficial resemblance to *O. leucorhoa*, Vieillot, is in reality quite different in several very obvious particulars, as follows: (1) The upper tail-coverts are pure (instead of grayish) white, terminated by a narrow band (about 0.30–0.50 of an inch wide at the broadest part) of black. (2) The rectrices (except two middle pairs) are pure white basally, the next to the middle pair being pale grayish on the basal portion. (This white is mostly concealed by the tail-coverts, but is partly exposed on the lateral pair, partly on account of the greater extent of the white itself, but also because the lateral coverts are shorter than the middle ones.) (3) The greater wing-coverts and outer webs of the tertials are much darker, offering less decided contrast with the general color of the wings. (4) The tail is far less deeply forked, the difference in length between the longest and shortest rectrices being from 0.15 to 0.30 of an inch instead of 0.75–0.90. The tarsus is also shorter, and there are additional minor differences scarcely worth noting.

O. cryptoleucura is, however, much more closely related to *O. macrodactyla* (Bryant)[1] of Guadalupe Island, Lower California, which also has the black tips to the longer upper tail-coverts and the concealed white at the base of the tail. *O. macrodactyla* is much larger, however, (wing 6.10–6.70, tail 3.30–3.90), the tail much more deeply forked (depth of fork 0.90–1.40), and feet proportionally larger (tarsus 0.86–1, middle toe with claw 1.10–1.18).

Both species are typical members of the subgenus *Cymochorea*, Coues, having very prominent nasal tubes, the outer toe longer than the middle, the latter (including its claw) about equal to the tarsus, and the first primary shorter than the fourth, as in the type species (*O. leucorhoa*).

[1] *Oceanodroma leucorhoa macrodactyla*, BRYANT, Proc. Cal. Ac. Sci., II, 1887.—(Guadalupe Island, Lower California; collection of W. E. Bryant).

Oceanodroma macrodactyla, AMERICAN ORNITHOLOGISTS' UNION, Check List, abridged ed. 1889, No. 1061.

The four adult males of *O. cryptoleucura* collected among the Galapagos by Mr. Townsend agree very closely with Hawaiian examples collected by Mr. V. Knudsen, though slight differences are apparent. They are perceptibly darker in general color, though this may be due to their fresher condition; the black tips to the longer upper tail-coverts average rather narrower; the bill is a little thicker, and the tarsi and toes are quite decidedly shorter, averaging 0.83 and 0.82, respectively, against 0.89 and 0.95 in Hawaiian specimens. It is possible, however, these slight differences might disappear if a larger number of specimens were compared.

Measurements of Oceanodroma cryptoleucura.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Fork of tail	Culmen.	Nasal tubes.	Depth of bill in front of nostrils.	Tarsus.	Middle toe.
41949	U.S.N.M.	Adult	Kauai, Hawaiian Islands.		6.25	2.88	....	.60	.28	.20	.92	.82
41450	U.S.N.M.	do	do		5.80	2.75	.20	.58	.27	.18	.88	.85
61260	U.S.N.M.	do	do		6.35	2.90	.30	.60	.28	.18	.85	.90
61261	U.S.N.M.	do	do		6.10	2.85	.20	.60	.30	.19	.95	.90
115461	U.S.N.M.	do	do		5.75	2.75	.25	.55	.25	.20	.88	.81
115462	U.S.N.M.	do	do		6.00	2.95	.30	.58	.25	.18	.88	.82
			Average		6.00	2.85	.25	.58½	.27	.19	.89	.85
132762	U.S.N.M.	Adult male	Off Albemarle Island, Galapagos.	1891. Apr. 11	5.90	2.75	.30	.55	.27	.22	.82	.88
132763	U.S.N.M.	do	Wenman Island	Apr. 4	5.85	2.80	.15	.61	.30	.20	.88	.85
132764	U.S.N.M.	do	do	do	6.00	3.00	.30	.60	.28	.20	.80	.78
	C.H.T.	do	do	do	6.00	3.00	.25	.59	.28	.20	.82	.77
			Average		5.94	2.89	.25	.59	.28	.20	.83	.82

Genus PROCELLARIA, Linnæus.

Procellaria, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 131. Type, by elimination, *P. pelagica*, Linnæus.

Range.—Cosmopolitan (pelagic). Galapagos Archipelago (one peculiar species).

PROCELLARIA TETHYS, Bonaparte.

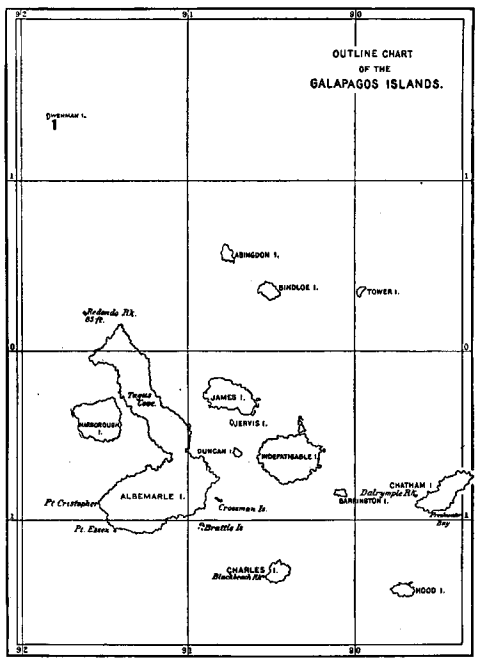
Procellaria tethys, BONAPARTE, Compt. Rend., XXXVIII, 1854, p. 662 (Notes Orn., p. 92) (Galapagos); XLII, 1856, fig. 769; Consp Av., II, 1857, p. 197.—COUES, Proc. Acad. Nat. Sci. Phila., 1864, p. 80.—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 507, pl. LXXXVIII, fig. 2 (Galapagos?).—RIDGWAY, Man. N. Amer. Birds, 1887, p. 70.—TOWNSEND, Proc. U. S. Nat. Mus., XIII, 1890, p. 142 (near equator, 400 and 600 miles east of Galapagos); Bull. Mus. Comp. Zool., XXVII, 1895, p. 126 (off Chatham Island, and 400 miles east of Galapagos).

Specific characters.—Similar to *P. pelagica*, Linnæus, but longer upper tail-coverts entirely white; no white on under side of wings; tail emarginated. Wing, 4.90–5.03; tail, 2.22–2.55, forked for 0.15–0.25; culmen,

0.43–0.52; nasal tubes, 0.20–0.30; tarsus, 0.80–0.92; middle toe (with claw), 0.72–0.78.

Range.—Galapagos Archipelago and contiguous waters. Galapagos (Bonaparte, Townsend); Wenman Island (Townsend); 400 miles and 600 miles east of Galapagos (Townsend); latitude 4° 22′ N., longitude 82° 03′ W. (Townsend).

ASCERTAINED RANGE OF THE GENUS PROCELLARIA, LINNÆUS, IN THE GALAPAGOS ARCHIPELAGO.



1. *Procellaria tethys*, Bonaparte.

Adult male.—No. 132767, U.S.N.M.; "Galapagos Islands," March 28, 1891; C. H. Townsend. Above uniform sooty black, the upper tail-coverts entirely white and the greater and middle wing-coverts light brown; entire under parts uniform deep sooty brown, the throat and chest slightly and the under surface of the wings considerably darker. Bill, legs, and feet entirely black. Total length (skin), 6.10; wing, 5.25 (second quill longest, first shorter than third); tail, 2.35, forked for 0.25; culmen, 0.45; nasal tubes, 0.25; tarsus, 0.88; middle toe and claw, 0.75.

Adult female.—No. 132769, U.S.N.M.; on equator, 600 miles east of the Galapagos, March 24, 1891; C. H. Townsend. In coloration exactly like the male as described above. Total length (skin), 5.80; wing, 4.90; tail, 2.22, forked for 0.15; culmen, 0.48; nasal tubes, 0.23; tarsus, 0.92; middle toe (with claw), 0.72.

The seven specimens collected by Mr. Townsend are essentially alike in coloration. One, however (No. 132768, adult male), has the feathers of the abdomen very much worn, thus showing a decidedly lighter hue than specimens with these feathers in perfect condition.

Another adult male (No. 117475, U.S.N.M.) is molting, and the newly acquired greater wing-coverts are of a soft grayish brown, contrasting strongly with the much browner color of the unshed greater coverts. Some of the under tail-coverts also have distinctly paler tips.

Measurements of Procellaria tethys.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Nasal tubes.	Tarsus.	Middle toe (with claw).	Fork of tail.
132766	U.S.N.M.	Adult	Wenman Island.	Apr. 4, 1891	5.35	2.55	0.50	0.25	0.90	0.72	0.20
132767	U.S.N.M.	Adult male...	Galapagos.....	May 28, 1891	5.25	2.35	.45	.25	.88	.75	.25
132768	U.S.N.M.	.....do	.....do.....	.....do	5.30	2.40	.50	.30	.92	.75	.15
132769	U.S.N.M.	Adult female.	600 miles east of Galapagos.	Mar. 24, 1891	4.90	2.22	.48	.23	.92	.72	.15
	C.H.T.	Adult male?..	400 miles east of Galapagos.	.....do	5.45	2.30	.52	.28	.92	.78	.20
132770	U.S.N.M.	Adult male...	Lat. 4° 22′; long. 82° 03′.	Mar. 1, 1891	4.90	2.30	.45	.25	.85	.72	.20
117475	U.S.N.M.	.....do	.....do.....	.....do	4.90	2.37	.43	.20	.80	.72	.....
			Average ..	.....	5.15	2.35	.48	.23	.88	.74	.19

Genus OCEANITES, Keyserling and Blasius.

Oceanites, KEYSERLING and BLASIUS, Wirb. Eur., I, 1840, p. xciii. Type, *Procellaria oceanica*, Kuhl.

Range.—Cosmopolitan (pelagic). Galapagos Archipelago (one species, found also along the Pacific coast of South America).

OCEANITES GRACILIS (Elliot).

Thalassidroma gracilis, ELLIOT, Ibis, October, 1859, p. 391 (west coast of America).[1]
Oceanites gracilis, COUES, Proc. Acad. Nat. Sci. Phila., 1864, p. 85.—RIDGWAY, Man. N. Amer. Birds, 1887, p. 71.

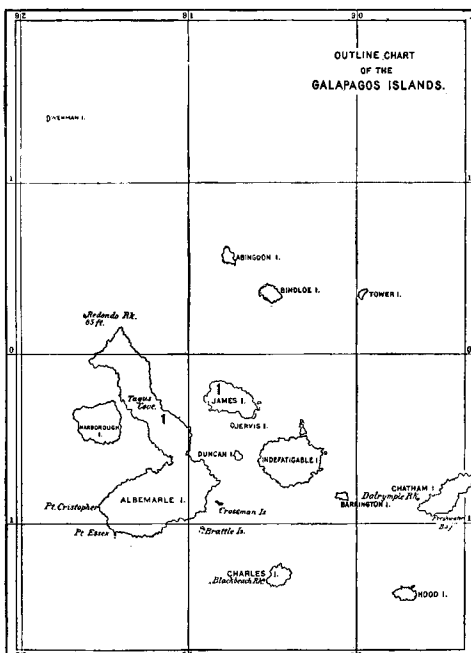
Specific character.—Belly white; webs of feet wholly dusky; tail more or less emarginated, and with basal portion of inner webs of three outermost rectrices white. Wing, 5.25–5.50; tail, 2.25–2.35; culmen, 0.40–0.48, from nasal tubes, 0.22–0.25; tarsus, 1.14–1.24; middle toe, 0.78–0.86.

Range.—Coast of Chile; Galapagos Archipelago: North Albemarle and James islands (Baur and Adams).

[1] Under "Remarks," Mr. Elliot says: "This species is very abundant on the coast of Chile;" there is thus reason to suppose that his type came from there.

Adult male.—No. 33923, U.S.N.M.; Chile, Maison Verreaux, No. 4096. General color dark sooty brown, darker on rump and remiges, the tail brownish black; greater wing-coverts light grayish brown, still paler on margins, forming a conspicuous oblique bar across closed wing; upper tail-coverts, sides of rump, and entire abdomen white; under tail-coverts dusky, with white, triangular, basal spots, mostly concealed; three outermost rectrices with basal portion of inner webs

ASCERTAINED RANGE OF THE GENUS OCEANITES, KEYSERLING AND BLASIUS, IN THE GALAPAGOS ARCHIPELAGO.



1. *Oceanites gracilis* (Elliot).

white, this forming an acute angle posteriorly, abruptly defined against the blackish color succeeding it. Bill, legs, and feet uniform black, the webs wholly dusky. Total length (skin), 5.50; wing, 5.20 (second quill longest, first shorter than third); tail, 2.35, forked for about 0.30; culmen, 0.43, from nasal tubes, 0.25; tarsus, 1.15; middle toe and claw, 0.90.

The six Galapagos specimens in the collection of Messrs. Baur and

Adams agree very closely with the one from Chile described above. In some, however, there is a distinct indication of a paler supraloral spot. The emargination of the tail is exceedingly slight, and disappears altogether when the tail is half spread. The three outer rectrices have the basal portion of their inner webs white, including the shaft, the white most extensive on the outer feather, where occupying more than the basal third, its posterior portion forming an acute angle with apex next to the shaft.

Measurements of Oceanites gracilis.

Number.	Collection.	Sex and age.	Locality.	Date.	Wing.	Tail.	Culmen.	Culmen from nasal tubes.	Tarsus.	Middle toe.
33923	U. S.	Adult male	Off coast of Chile		5.20	2.35	.43	.25	1.15	.....
500	B. & A.	Adult female	North Albemarle Island.	Aug. 10, 1891	5.30	2.30	.43	.25	1.24	.86
505	B. & A.	Adult male	do	Aug. 11, 1891	5.45	2.30	.42	.22	1 20	.82
533	B. & A.	Adult female	James Island	Aug. 15, 1891	5.30	2.30	.40	.25	1 20	.80
534	B. & A.	Adult male	do	Aug. 13, 1891	5.25	2.25	.48	.24	1.20	.78
535	B. & A.	Adult female	do	do	5.25	2.32	.45	.25	1.15	.83
536	B. & A.	do	do	do	5.50	2.35	.42	.25	1 14	.78
			Average		5.32	2.31	.43	24	1.18	.81

Family SPHENISCIDÆ.

Genus SPHENISCUS, Brisson.

Spheniscus, BRISSON, Orn., VI, 1790, p. 96. Type, *Aptenodytes magellanicus*, Forster.
Dyspsicles, GLOGER, Hand- und Hilfsbuch Naturg., "1842" (1841), p. 476. (Substitute for *Spheniscus*.)

Generic characters.—"Bill moderate, much compressed, strong, with the culmen rounded and curved at the tip, which is acute; the tip of the lower mandible suddenly truncated, and the gonys moderate and curved upward; the nostrils rather rounded, and placed in a lateral groove near the middle of the bill. Wings imperfect, and covered with small scales. Toes long, the lateral ones unequal, and united to the middle toe by a web; the hind toe very small, and united to the tarsus at the base of the inner toe; the claws long, compressed, and slightly curved."[1]

Range.—Antarctic seas, and adjacent parts of South America and southern Africa. Galapagos Archipelago (one peculiar species).

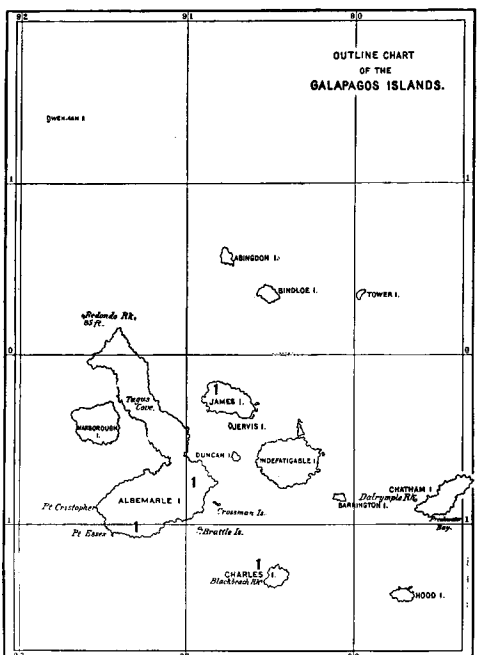
SPHENISCUS MENDICULUS, Sundevall.

Spheniscus mendiculus, SUNDEVALL, Proc. Zool. Soc., 1871, pp. 126, 129 (James Island, Galapagos).—SALVIN, Trans. Zool. Soc., IX, Pt. IX, 1876, p. 508, pl. LXXXIX (James Island).—WOLF, Besuch. aus den Galápagos Inseln, 1879, p. 42 (Post-Office Bay, Charles Island).—RIDGWAY, Proc. U. S. Nat. Mus., XII, 1889, p. 119 (Albemarle Island).

[1] Gray, Genera of Birds, III, p. 640.

Specific characters.—Similar to *S. magellanicus* (Forster[1]), from the Falkland Islands and Straits of Magellan, but with longer and more slender bill; mandible with basal two-thirds or more yellowish, instead of wholly black; size less; chin white; postocular white stripe much narrower; no well-defined dusky band across fore neck (above the one across chest), and without whitish posterior margin to wing. Length (skin), about 17.50; wing (from insertion), about 5.50; culmen, 2.20; middle toe, with claw, 2.30–2.40.

ASCERTAINED RANGE OF THE GENUS SPHENISCUS, BRISSON, IN THE GALAPAGOS ARCHIPELAGO.



1. *Spheniscus mendiculus*, Sundevall.

Range.—Galapagos Archipelago: Albemarle Island (*Albatross*); South Albemarle Island (Baur and Adams); Post-Office Bay, Charles Island (Wolf); James Island (Kinberg, Baur and Adams).

Adult.—No. 115982, U.S.N.M.; Albemarle Island, April 10, 1888; C. H. Townsend. Above slate-black, each feather with a subterminal pair of

[1] *Aptenodytes magellanicus*, FORSTER, Nov. Comm. Gott., III, 5, p. 143, pl. v.—*Spheniscus magellanicus*, SCLATER, Proc. Zool. Soc., 1860, p. 390.

minute brownish gray specks, producing an indistinct finely speckled appearance; sides of head and entire throat plain brownish gray, darker on auriculars, which are bordered above and behind by a narrow, broken, postocular streak of white, which, curving downward behind the auriculars, crosses the lower throat in a broader band, broken by the partly exposed deep brownish gray bases to the feathers; fore neck, medially, mottled or clouded with white tips to the feathers, their bases being deep brownish gray, the sides of the neck being uniformly of this color; a broken arched band of white on the chest, with a broader one of deep brownish gray immediately beneath it, whose lateral extremities, as are also those of the adjoining white band, are continued posteriorly along the sides and flanks to the insertion of the legs; rest of under parts, also a large spot immediately in front of eye and a V-shaped mark on the chin, extending obliquely upward to the anteorbital spot, white. Maxilla mainly blackish, but with the lower edge and a space in front of nostrils light brownish; mandible light brownish, with about 0.60 of an inch of its terminal portion, its upper edge (narrowly) and part of its basal portion, blackish; legs and feet wholly blackish.[1] Length (skin), about 17.50; wing (from insertion), about 5.40; culmen, 2.20; depth of bill at base, 0.75; tarsus, from lower edge of tibial feathers, in front, 1.09; middle toe (with claws), 2.32.

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List of Books and Papers pertaining to the Avifauna of the Galapagos Archipelago.

GOULD, J.: [Remarks on a group of ground finches from Mr. Darwin's collection, with characters of the new species.]

Proc. Zool. Soc. London, Pt. v, 1837, pp. 4-7.

The so-called "ground finches" are divided into four genera, which are characterized under the following generic names: *Geospiza* (type, *G. magnirostris*, Gould), p. 5; *Camarhynchus* (type, *C. psittacula*, Gould), p. 6; *Cactornis* (type, *C. scandens*, Gould), p. 6; *Certhidea* (type, *C. olivacea*, Gould), p. 7. The new species are as follows: *Geospiza magnirostris, G. strenua, G. fortis, G. nebulosa, G. fuliginosa*, p. 5; *G. dentirostris, G. parvula, G. dubia*, p. 6; *Camarhynchus psittacula, C. crassirostris*, p. 6; *Cactornis scandens, C. assimilis*, p. 7; *Certhidea olivacea*, p. 7.

Based on specimens collected by Charles Darwin during the voyage of the *Beagle*. No localities, except the general one of "Galapagos Islands," are mentioned.

GOULD, J.: [Observations on the raptorial birds in Mr. Darwin's collection, with characters of the new species.]

Proc. Zool. Soc. London, Pt. v, 1837, pp. 9-11.

The new Galapagos species described are *Polyborus galapagoensis*, p. 9, and *Otus (Brachyotus) galapagoensis*, p. 10.

GOULD, J.: [Exhibition of the fissirostral birds from Mr. Darwin's collection, and characters of the new species.]

Proc. Zool. Soc. London, Pt. v, 1837, p. 22.

Hirundo concolor is the only Galapagos species mentioned.

[1] "Light parts of feet and bill light pinkish cream-buff." (Adams, MS.) "Male, iris walnut brown, with lighter inner ring." (Adams.)

GOULD, J.: [Characters of two new species of the genus *Sterna*, a species of cormorant, and three species of the genus *Orpheus*, from the Galapagos, in the collection of Mr. Darwin.]

Proc. Zool. Soc. London, Pt. v, 1837, pp. 26–27.

The Galapagoan species are *Orpheus trifasciatus*, *O. melanotis*, and *O. parvulus*, characterized on page 27.

"NÉBOUX, ——: Descriptions d'oiseaux nouveaux recueillis pendant l'expedition de la Vénus. Revue Zool., III, 1840, pp. 289–291."

(Not seen. Title from Dr. Baur.)

GOULD, JOHN: The | Zoology | of | the Voyage of H. M. S. Beagle, | under the command of Captain Fitzroy, R. N., | during the years | 1832 to 1836.—Published with the approval of | the Lords Commissioners of Her Majesty's Treasury. | Edited and Superintended by | Charles Darwin, Esq., M. A., F. R. S., Sec. G. S. | Naturalist to the Expedition. | —— | Pt. III. | Birds, | by | John Gould, Esqr. F. L. S. | —— | London: | Published by Smith, Elder and Co. 65, Cornhill. | MDCCCXLI. | [4to. 4 p. ll. pp. ii, 156, 4 ll., 50 colored plates.]

Most of the Galapagoan species had been previously described by Mr. Gould in Proc. Zool. Soc. London, Pt. v, 1837, pp. 4–7, 9–11, 22, and 26–27, but the following are additional thereto: *Strix punctatissima*, "G. R. Gray," p. 34, pl. IV (James Island); *Pyrocephalus nanus*, p. 45, pl. VII; *Pyrocephalus dubius*, p. 46; *Myiobius magnirostris*, p. 48, pl. VIII (Chatham Island); *Sylvicola aureola*, p. 86, pl. XXVIII; *Zenaida galapagoensis*, p. 115, pl. XLVI; *Totanus fuliginosus*,[1] p. 130; *Zapornia spilonota*, p. 132, pl. XLIX; *Larus fuliginosus*, p. 141. (The locality, except where otherwise stated above, is given simply as "Galapagos Archipelago.") The following previously described species are figured: *Craxirex galapagoensis*, pl. II; *Otus galapagoensis*, pl. III; *Progne modestus*, pl. V; *Mimus trifasciatus*, pl. XVI; *M. melanotis*, pl. XVII; *M. parvulus*, pl. XVIII; *Geospiza magnirostris*, pl. XXXVI; *G. strenua*, pl. XXXVII; *G. fortis*, pl. XXXVIII; *G. parvula*, pl. XXXIX; *Camarhynchus psittacula*, pl. XL; *C. crassirostris*, pl. XLI; *Cactornis scandens*, pl. XLII; *C. assimilis*, pl. XLIII; *Certhidea olivacea*, pl. XLIV. *Craxirex* (type, *Polyborus galapagoensis*, Gould), p. 22, is described as a new genus.

HABEL, Dr. [A.]: [Exhibition of and remarks upon some birds from the Galapagos Islands.]

Proc. Zool. Soc. London, 1869, p. 433.

(Brief paragraph, referring to his collection of "upwards of 300 specimens, referable to about 70 species."[2])

SCLATER, P. L., and SALVIN, OSBERT: Characters of new Species of Birds collected by Dr. Habel in the Galapagos Islands. By P. L. Sclater, M. A., Ph. D., F. R. S., and Osbert Salvin, M. A.

Proc. Zool. Soc. London, 1870, pp. 322–327, figs. 1–6.

Based on a collection made by Dr. A. Habel, of New York, the total number of specimens being 460, representing three islands, as follows: Indefatigable Island (267 specimens); Bindloe Island (94); Abingdon Island (84); island unspecified (15). A list of the 37 species is given on page 323, showing the number of specimens collected of each, and also the number of specimens procured on each island. The new species described are as follows: (1) *Certhidea fusca*, p. 324, fig. 1, Abingdon and Bindloe islands; (2) *Camarhynchus variegatus*, p. 324, fig. 2, Abingdon and Bindloe islands; (3) *Camarhynchus habeli*, p. 325, fig. 3, Abingdon and Bindloe islands; (4) *Camarhynchus prosthemelas*, p. 325, fig. 4, Indefatigable Island; (5) *Cactornis abingdoni*, p. 326, fig. 5, Abingdon Island; (6) *Cactornis pallida*, p. 327, fig. 6, Indefatigable Island; (7) *Nycticorax pauper*, p. 327, Indefatigable Island.

[1] = *Heteractitis incanus* (Gmelin).

[2] Actual numbers, 460 specimens and 37 species, as determined by Messrs. Sclater and Salvin. Cf. Sclater and Salvin, Proc. Zool. Soc., 1870, p. 323.

SUNDEVALL, Prof. CARL J., F. M. Z. S. On Birds from the Galapagos Islands. *Proc. Zool. Soc. Lond.*, 1871, pp. 124–130.

Based on collections made by Dr. Kinberg, zoologist and surgeon of the Swedish frigate *Eugenie* (Commander Virgin), during nine days of May, 1852. Twenty-six species are enumerated, of which the following are described as new: (1) *Ardea plumbea*, pp. 125, 127, James Island; (2) *Spheniscus mendiculus*, pp. 126, 129, James Island. Five additional species are for the first time recorded from the Galapagos, as follows: *Hæmatopus "palliatus"* (=*H. galapagensis*, Ridgway); *Pelecanus "fuscus"* (=*P. californicus*, Ridgway); *Dysporus cyanops; D. "leucogaster"* (=*Sula brewsteri*, Goss); *Anas maculirostris*, Lichtenstein (=*A. versicolor*, Vieillot). There are also critical notes on the following species: *Mimus melanotis*, Gould (p. 126, descriptions of the various plumages); *M. trifasciatus*, Gould, *M. parvulus*, Gould, *Myiarchus magnirostris*, *Buteo galapagensis* (p. 127); *Ardea violacea*, L., (*varietas?*), pp. 128, 129.

SCLATER, PHILIP LUTLEY: [Extract from a report of the visit of H. M. S. *Peterel* to the Galapagos Islands.]

Proc. Zool. Soc. Lond., 1876, pp. 178, 179.

Brief mention only is made of the birds, their excessive tameness being alluded to. No particular species named.

SALVIN, OSBERT: On the Avifauna of the Galapagos Archipelago. By Osbert Salvin, M. A., F. R. S., etc. <Transactions of the Zoological Society of London, IX, Pt. IX, May, 1876, pp. 447–510, pls. LXXXIV–LXXXIX, with a map of the archipelago.

This most important contribution to our knowledge of Galapagos ornithology is a masterly treatment of the subject, under the following separate headings:

I. Introductory remarks. Situation, number, and size of the different islands of the archipelago; geological formation; climate, etc.; date of their discovery; attempts at colonization; subsequent intercourse with the mainland, and its effect on the indigenous fauna; Dr. Habel's account of his visit (pp. 447–461).

II. Short account of the literature relating to the birds of the Galapagos (pp. 461–462).

III. List of species of birds found in the archipelago, and remarks on their relationship to the birds of other countries—(*a*) as to species, (*b*) as to genera, and (*c*) as to families (pp. 463–466).

IV. Summary of the birds found on each island (pp. 466–469).

V. On the variation of the species in certain genera and the consequent difficulty in defining specific limits (pp. 469–470).

VI. Account of each species, with references, description of peculiar species, their distribution, habits, and general remarks (pp. 471–509).

VII. Concluding remarks (pp. 509–510).

The total number of species given is 57, of which only one (*Œstrelata phœopygia*, p. 507, pl. LXXXVIII, fig. 1) is described as new. Those figured are as follows: pl. LXXXV, *Camarhynchus variegatus*, ♂ and ♀; pl. LXXXVI, *Camarhynchus habeli*, ♂ and ♀; pl. LXXXVII, *Larus fuliginosus*, adult and immature; pl. LXXXVIII, figs. 1 and 3, *Œstrelata phœopygia*, fig. 2, *Procellaria tethys*; pl. LXXXIX, *Spheniscus mendiculus*.

SHARPE, R. BOWDLER: Account of the Zoological Collection made during the visit of H. M. S. 'Peterel' to the Galapagos Islands. Communicated by Dr. Albert Günther, F. R. S., V. P. Z. S., Keeper of the Zoological Department, British Museum. I, Birds. By R. Bowdler Sharpe.

Proc. Zool. Soc., 1877, pp. 65, 66.

Based on a very small collection of birds made on Albemarle and Charles islands by Commander W. E. Cookson, in June, 1895. Only four species of birds are mentioned, as follows: *Mimus parvulus*, Albemarle Island (p. 65); *Dendræca aureola*, Charles Island (p. 66); *Geospiza fuliginosa*, Albemarle Island (p. 66), and *Pyrocephalus "nanus* (Gould)" (=*P. carolensis*, Ridgway), Charles Island (p. 66). The names of these species are followed by critical notes.

SHARPE, R. BOWDLER: Notes on Anous.
"*Philos. Trans.*, CLXVIII, 1879, 469."
Anous galapagensis described as a new species. (Citation from Dr. Baur.)

SALVIN, OSBERT: A List of the Birds collected by Capt. A. H. Markham on the West Coast of America. By Osbert Salvin, M. A., F. R. S.
Proc. Zool. Soc. London, 1883, pp. 419–432.
The following Galapagos species (collected in 1881 or 1882) are mentioned: *Dendræca aureola*, Charles Island (p. 420); *Geospiza fortis*, Charles Island (421); *Pyrocephalus nanus* (=*P. carolensis*, Ridgway), Charles Island (p. 424); *Pelecanus fuscus* (=*P. californicus*, Ridgway), Charles Island (p. 427); *Sula cyanops*, Charles Island (p. 427); *Dafila bahamensis* (=*Pœcilonetta galapagensis*, Ridgway), Charles Island (p. 428); *Butorides plumbeus*, Charles Island (p. 428); *Numenius borealis*, Charles Island (p. 429—new to the Galapagos!); *Anous galapagensis*, Charles Island (p. 430); *Puffinus obscurus* (=*P. subalaris*, Townsend?), Charles Island (p. 431).

WOLF, THEODOR: "Ein Besuch. aus den Galápagos Inseln. Heidelberg, 1879, 44 pp." (Not seen; title from Dr. G. Baur.)
Contains interesting information concerning an albatross (supposed to be *Diomedea exulans*) which bred abundantly on Hood Island and also the first description (unaccompanied by a name, however) of *Spheniscus mendiculus!*

RIDGWAY, ROBERT: Description of a new species of Oyster-Catcher from the Galapagos Islands.
The Auk, III, July, 1886, p. 331.
Hæmatopus galapagensis, from Chatham Island, where collected August 16, 1884, by Dr. William H. Jones, U. S. N., surgeon U. S. S. *Wachusett.*

RIDGWAY, ROBERT: Scientific results of explorations by the United States Fish Commission steamer *Albatross*. [Published by permission of Hon. Marshall McDonald, late United States Commissioner of Fish and Fisheries.] No. I, Birds collected on the Galapagos Islands in 1888.
Proc. U. S. Nat. Mus., XII, No. 767, Feb. 5, 1890, pp. 101–128.
Based upon a collection made, in April, 1888, by Prof. Leslie A. Lee, naturalist of the expedition, assisted by Mr. Charles H. Townsend and Mr. Thomas Lee.
Forty-seven species are mentioned, of which the following are described as new: (1) *Nesomimus* (new genus: Type, *Orpheus melanotis*, Gould) *macdonaldi*, Hood Island, p. 103, fig. 1; (2) *Nesomimus personatus*, Abingdon Island, p. 104; (3) *Certhidea cinerascens*, Hood Island, p. 105; (4) *Geospiza conirostris*, Hood Island, p. 106, fig. 2; (5) *Geospiza media*, Hood Island, p. 107, fig. 3; (6) *Cactornis brevirostris*, Charles Island, p. 108, fig. 4; (7) *Camarhynchus townsendi*, Charles Island, p. 110, fig. 5; (8) *Camarhynchus pauper*, Charles Island, p. 111, fig. 6; (9) *Pœcilonetta galapagensis*, Charles Island, p. 115. Besides these, two other species were named provisionally, as follows: *Cactornis hypoleuca* (if distinct from *C. pallida*, Sclater and Salvin), James Island, p. 109, in text; *Pyrocephalus minimus*, Chatham Island, p. 113, in text.

BAUR, G.: On the origin of the Galapagos Islands.
American Naturalist, XXV, 1891, pp. 217–229, 307–326.
Dr. Baur's theory is that the Galapagos "are continental islands, originated through subsidence," and many facts of distribution are adduced to support this view of their origin. This paper was written before Dr. Baur visited the Galapagos.

BAUR, G.: [An account of his trip to the Galapagos Islands.]
American Naturalist, XXV, 1891, pp. 902–907.
A letter dated "Chatham Island, . August 28, 1891, containing a very interesting account of his investigations upon the different islands of the group, all of which, according to his views, confirm his previously expressed opinion as to the origin of the islands. The article should be carefully read in this connection.

AGASSIZ, ALEXANDER: Bulletin of the Museum of Comparative Zoölogy at Harvard College. | XXIII. No. 1. | —— | Reports on the Dredging Operations off the West Coast of | Central America to the Galapagos, to the West Coast | of Mexico, and in the Gulf of California, in charge of | Alexander Agassiz, carried on by the U. S. Fish Commis- | sion Steamer *Albatross*, Lieut. Commander Z. L. Tanner, | U. S. N., commanding. | II. | General Sketch of the Expedition of the *Albatross*, | from February to May, 1891. | By Alexander Agassiz. | [Published by Permission of Marshall McDonald, U. S. Fish Commissioner.] | With Twenty-Two Plates. | Cambridge, U. S. A.: | Printed for the Museum. | February, 1892. |

8vo., pp. 89.

This important work contains no special reference to birds, but excellent descriptions of the several islands are given besides other information of much interest in connection with the subject.

RIDGWAY, ROBERT: Descriptions of twenty-two new species of birds from the Galapagos Islands.

Proc. U. S. Nat. Mus., XVII (advance sheets published November 15, 1894), pp. 357-370.

The new species herein described were contained in the very large and valuable collection of Galapagos birds made by Dr. G. Baur and Mr. C. F. Adams, in 1891, which was referred to the author for determination of the species soon after the return of those gentlemen from their highly successful exploration of that remarkable island group. Many of the specimens having been collected on islands never before visited by a collector, the number of new species found among them was, as might be expected, unusually large. The new forms described are the following: (1) *Nesomimus bauri*, Tower Island, p. 357; (2) *Nesomimus bindloei*, Bindloe Island, p. 358; (3) *Nesomimus adamsi*, Chatham Island, p. 358; (4) *Certhidea salvini*, Indefatigable Island, p. 358; (5) *Certhidea bifasciata*, Barrington Island, p. 359; (6) *Certhidea mentalis*, Tower Island, p. 359; (7) *Certhidea albemarlei*, Albemarle Island, p. 360; (8) *Certhidea luteola*, Chatham Island, p. 360; (9) *Geospiza barringtoni*, Barrington Island, p. 361; (10) *Geospiza propinqua*, Tower Island, p. 361; (11) *Geospiza bauri*, James Island, p. 362; (12) *Geospiza albemarlei*,[1] Albemarle Island, p. 362; (13) *Geospiza fraterc ula*,[1] Abingdon Island, p. 363; (14) *Geospiza debilirostris*,[1] James Island, p. 363; (15) *Geospiza acutirostris*, Tower Island, p. 363; (16) *Camarhynchus rostratus*,[1] James Island, p. 363; (17) *Camarhynchus productus*, Albemarle Island, p. 364; (18) *Camarhynchus salvini*,[2] Chatham Island, p. 364; (19) *Camarhynchus affinis*, Albemarle Island, p. 365; (20) *Pyrocephalus carolensis*,[1] Charles Island, p. 365; (21) *Pyrocephalus intercedens*, Indefatigable Island, p. 366; (22) *Pyrocephalus abingdoni*,[1] Abingdon Island, p. 367.

There are also critical remarks (p. 361) on the "*Cactorni*" of Indefatigable, Albemarle, and Jervis islands, which collectively were doubtfully identified with *Cactornis assimilis*, Gould,[2] and *Pyrocephalus dubius*, Gould (pp. 368-370), to which the Chatham Island form is referred, and of which detailed descriptions and full synonymy are given.

TOWNSEND, C. H.: Birds from Cocos and Malpelo Islands, with notes on Petrels obtained at sea.

Bull. Mus. Comp. Zoology, XXVII, No. 3, pp. 121-126, 2 colored plates.

Three species of *Procellariidæ* from the Galapagos Archipelago are mentioned: *Oceanodroma cryptoleucura* (off Wenman Island), *Procellaria tethys* (off Chatham Island), and *Puffinus* "*tenebrosus*, Pelz.,"=*P. subalaris*, Townsend, this paper, p. 650 (off Chatham and Wenman islands).

The two colored plates represent *Cocornis agassizi*, Townsend, and *Nesotriccus ridgwayi*, Townsend, both new species (and new genera) from Cocos Island.

[1] From the *Albatross* collection of 1888. [2] From the *Albatross* collection of 1891.

RIDGWAY, ROBERT: Preliminary descriptions of some new birds from the Galapagos Archipelago.

Proc. U. S. Nat. Mus., XVIII, No. 1067, Apr. 23, 1896, pp. 293, 294.

These new forms are the result of further examination of specimens in Dr Baur's collection as well as National Museum specimens collected by the naturalists of the *Albatross* in 1888 and 1891. They are as follows: (1) *Geospiza pachyrhyncha*,[1] Tower Island, p. 293; (2) *Geospiza fatigata*,[2] Indefatigable Island, p. 293; (3) *Camarhynchus bindloei*,[1] Bindloe Island, p. 294; (4) *Camarhynchus compressirostris*,[1] Jervis Island, p. 294; (5) *Camarhynchus incertus*,[1] James Island, p 294.

[1] From Dr Baur's collection.

[2] From the *Albatross* collection.

EXPLANATION OF PLATES.

PLATE LVI.

FIG. 1. Nesomimus parvulus, Gould, No. 115972, U.S.N.M.; Albemarle Island, Galapagos; *Albatross* collection.

2. Nesomimus adamsi, Ridgway. Type, in Dr. Baur's collection; Bindloe Island, Galapagos.

3. Nesomimus melanotis, Gould, No. 115986, U.S.N.M.; James Island, Galapagos; *Albatross* collection.

4. Nesomimus bauri, Ridgway. Type, in Dr. Baur's collection; Tower Island, Galapagos.

5. Nesomimus personatus, Ridgway. Type, No. 116098, U.S.N.M.; Abingdon Island, Galapagos; *Albatross* collection.

6. Nesomimus macdonaldi, Ridgway. Type, No. 116066, U.S.N.M.; Hood Island, Galapagos; *Albatross* collection.

7. Camarhynchus (Cactospiza) pallidus (Sclater and Salvin)? Type of Cactornis hypoleuca, Ridgway, No. 115997, U.S.N.M.; James Island, Galapagos; *Albatross* collection.

8. Camarhynchus (Cactospiza) productus, Ridgway. Type, in Dr. Baur's collection; Albemarle Island.

9. Camarhynchus salvini, Ridgway. Type, No. 125976, U.S.N.M.; Chatham Island, Galapagos; *Albatross* collection.

10. Camarhynchus prosthemelas, Sclater and Salvin, No. 116009, U.S.N.M.; James Island, Galapagos; *Albatross* collection.

11. Camarhynchus pauper, Ridgway, No. 125968, U.S.N.M.; Charles Island, Galapagos; *Albatross* collection.

12. Camarhynchus compressirostris, Ridgway. Type, No. 471, Dr. Baur's collection; Jervis Island, Galapagos.

13. Camarhynchus habeli, Sclater and Salvin, No. 116130, U.S.N.M.; Abingdon Island, Galapagos; *Albatross* collection.

14. Camarhynchus psittaculus, Gould, No. 561, female adult, Dr. Baur's collection; James Island, Galapagos.

15. Camarhynchus psittaculus, Gould?. Type of Camarhynchus townsendi, Ridgway, No. 115915, U.S.N.M.; young male; Charles Island, Galapagos; *Albatross* collection.

16. Camarhynchus psittaculus, Gould ?. Type of C. rostratus, Ridgway, No. 116006, U.S.N.M., male adult; James Island, Galapagos; *Albatross* collection.

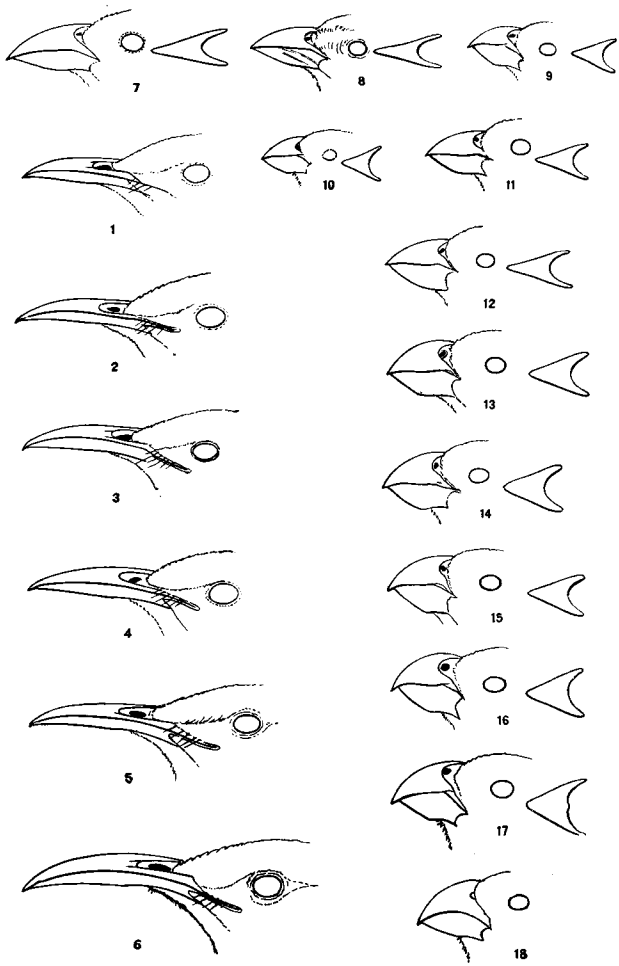
17. Camarhynchus (Platyspiza) variegatus, Sclater and Salvin, No. 125972, U.S.N.M.; Chatham Island, Galapagos; *Albatross* collection.

18. Camarhynchus (Platyspiza?) crassirostris, Gould. (From Gould, Zool. Voy. *Beagle*, III, pl. XLI.)

PLATE LVII.

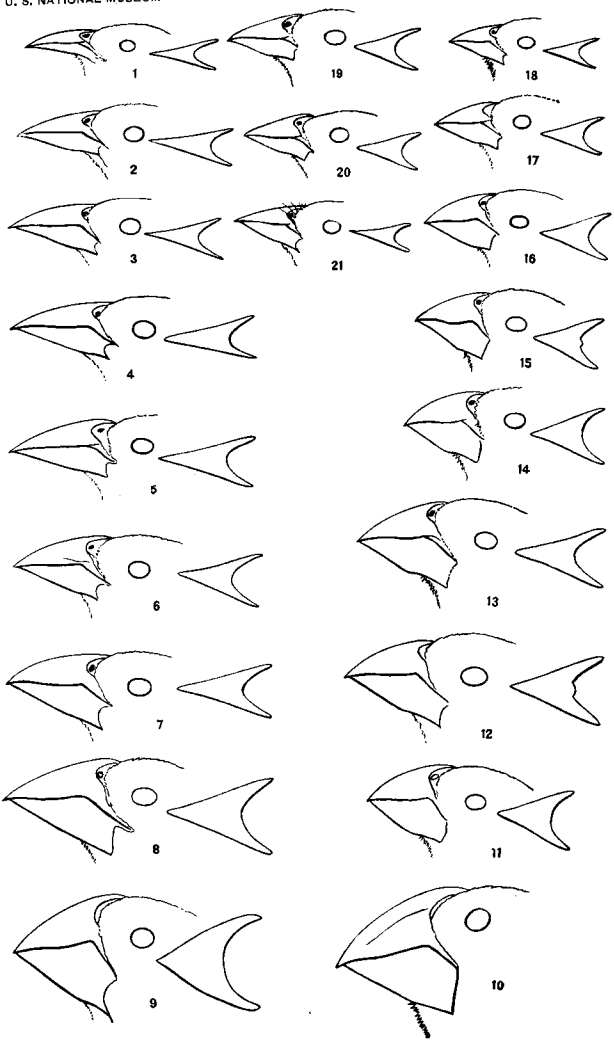
FIG. 1. Cocornis agassizi, Townsend. Type, No. 131680, U.S.N.M.; Cocos Island; C. H. Townsend.

2. Geospiza (Cactornis) scandens (Gould). Specimen in Dr. Baur's collection; James Island, Galapagos.
3. Geospiza (Cactornis) intermedia, Ridgway. Type, No. 115916, U.S.N.M.; Charles Island, Galapagos; *Albatross* collection
4. Geospiza (Cactornis) barringtoni, Ridgway. Type, in Dr. Baur's collection; Barrington Island, Galapagos.
5. Geospiza (Cactornis) abingdoni, Sclater and Slavin. No. 116126, U.S.N.M.; Abingdon Island, Galapagos; *Albatross* collection.
6. Geospiza (Cactornis) brevirostris, Ridgway. Type, No. 115920, U.S.N.M.; Charles Island, Galapagos; *Albatross* collection.
7. Geospiza (Cactornis) propinqua, Ridgway. Type, in Dr. Baur's collection; Tower Island, Galapagos.
8. Geospiza conirostris, Ridgway. Type, No. 116070, U.S.N.M., Hood Island; Galapagos; *Albatross* collection.
9. Geospiza pachyrhyncha, Ridgway. Type, in Dr. Baur's collection; Tower Island, Galapagos.
10. Geospiza magnirostris, Gould. (From Salvin, Trans. Zool. Soc. Lond., IX, Pt. IX., p. 479.)
11. Geospiza dubia, Gould, No. 125912, U.S.N.M.; Chatham Island, Galapagos; *Albatross* collection.
12. Geospiza bauri, Ridgway. Type, in Dr. Baur's collection; James Island, Galapagos.
13. Geospiza media, Ridgway. Type. No. 116072, U.S.N.M.; Hood Island, Galapagos; *Albatross* collection.
14. Geospiza fortis, Gould?. Type of G. albemarlei, Ridgway, No. 115977, U.S.N.M.; Albemarle Island, Galapagos; *Albatross* collection.
15. Geospiza fortis, Gould, No. 125936, U.S.N.M., immature male; Charles Island, Galapagos; *Albatross* collection.
16. Geospiza fratercula, Ridgway. Type, No. 116110, U.S.N.M.; Abingdon Island, Galapagos; *Albatross* collection.
17. Geospiza fuliginosa, Gould, No. 125927, U.S.N.M.; Chatham Island, Galapagos; *Albatross* collection.
18. Geospiza parvula, Gould, No. 77755, U.S.N.M.; Abingdon Island, Galapagos; Dr. A. Habel.
19. Geospiza debilirostris, Ridgway. Type, No. 116003, U.S.N.M.; James Island, Galapagos; *Albatross* collection.
20. Geospiza difficilis, Sharpe. No. 116117, U.S.N.M.; Abingdon Island, Galapagos; *Albatross* collection.
21. Geospiza acutirostris, Ridgway. Type, in Dr. Baurs' collection; Tower Island, Galapagos.



SPECIFIC VARIATIONS IN FORM OF BILL IN NESOMIMUS AND CAMARHYNCHUS.

FOR EXPLANATION OF PLATE SEE PAGE 669.



SPECIFIC VARIATIONS IN FORM OF BILL IN GENUS GEOSPIZA.

FOR EXPLANATION OF PLATE SEE PAGE 670.

ON THE FOSSIL PHYLLOPOD GENERA, DIPELTIS AND PROTOCARIS, OF THE FAMILY APODIDÆ.

By CHARLES SCHUCHERT.
Assistant Curator, Department of Paleontology.

THE GENUS *Dipeltis* was established by Professor A. S. Packard in 1885 on a specimen in the collection of Mr. R. D. Lacoe, "not satisfactorily preserved, so that its exact relations are not readily determined though it will be recognizable as a Cyclus-like form." In the following year the same author gave a more extended description, with a figure of the type and a restoration of the dorsal side of the animal. Recently, better preserved specimens of *D. diplodiscus* have been found at Morris, Illinois—one by Mr. J. C. Carr, and another, a nearly perfect individual, by Mr. L. E. Daniels. All these fossils may be only sheddings, since they are more or less cracked along the median ridge of the head shield and the two large thoracic segments. An excellent specimen representing a new species, which preserves the cercopoda and probably impressions of the anterior limbs, was found some years ago by Mr. J. C. Carr.

It is now certain that *Dipeltis* has no direct relationship with *Cyclus*, nor is it a Xiphosuran, as supposed by Packard; also that the restoration by the latter author is quite faulty, and further that the family Dipeltidæ must be abandoned. The reason for these changes is that *Dipeltis* is closely related to *Apus*, as will be readily seen in Plate LVIII, figs. 2–6.

Genus DIPELTIS, Packard (emend).

Generic characters.—Head shield subovate or subtriangular, nearly smooth with two submarginal ocelli, and a pair of close-set eyes anterior to the middle. Lateral angles acute in the adolescent stage, becoming less so with maturity. Head shield not extended in one piece over the abdomen, as in other Apodidæ, but followed by two very large thoracic segments, which at maturity have the lateral portions much extended posteriorly, but less so in young specimens. Abdomen with from six to nine segments. The telson, or anal segment (seventh in *D. carri*, tenth in *D. diplodiscus*), is more or less wide, and bears laterally two slender cercopoda, or cirri.

Type.—D. diplodiscus, Packard.

Dipeltis differs conspicuously from *Apus* and *Lepidurus* in its narrower head shield followed by two large thoracic segments. If these three parts in *Dipeltis* were united into one, there would result a cephalon in general form very much like that of *Lepidurus*. The small number of abdominal segments is another conspicuous difference as compared with the recent genera.

At first sight, *Dipeltis* might not be regarded as a member of the Apodidæ, because of the two peculiar, and disproportionately large, segments back of the cephalon. The presence, however, of long cercopoda and a wide anal segment, the position of the eyes, and the Apus-like head shield are all characters of this family. The few and wide abdominal segments are not unlike those of *Lepidurus*. On the other hand, the very suggestive theory may be advanced that the cephalon and the two large body segments of *Dipeltis* may represent a mature condition of a stage in the development of *Limulus*, since the cephalothorax of this genus is composed of seven segments, five belonging to the head and two to the thorax. Against this view the fact may be urged that no pre-Carboniferous members of the Hemiaspidæ, ancestors of *Limulus*, show any near relationship to *Dipeltis*. The abdomen of the latter has from seven to ten segments, and the anal piece with its two long cercopoda is in complete harmony with the Apodidæ and wholly unlike *Limulus*.

The nature of the waters in which *Dipeltis* lived was marine. These animal remains are found in nodules, associated with *Prestwichia*, *Eurypterus*, malacostracous, schizopod, and decapod crustaceans, arachnids, insects, *Aviculopecten*, and *Solenomya*, and numerous ferns. This evidence indicates that the waters in which the rocks of Mazon Creek were deposited were neither fresh nor brackish, but marine (probably estuarine), and into these the plants and insects have been blown or washed from the not far distant land.

DIPELTIS DIPLODISCUS, Packard.

(Plate LVIII, figs. 2–5.)

Dipeltis diplodiscus, PACKARD, Amer. Nat., 1885, p. 293; Mem. Nat. Acad. Sci., III, Pt. 2, p. 145, pl. v, figs. 2, 2*a*.

Head shield twice or more than twice as broad as long. In the adolescent stage, it is somewhat drawn out posteriorly at the sides, but these extensions disappear with maturity. Upon the head shield there is a more or less sharply elevated median carina, which is also present on the two large thoracic segments. On each side of this ridge, immediately within the anterior edge, are situated two small shallow pits, which are interpreted as ocelli, and posterior to these are two faintly preserved eye spots. Cephalon nearly smooth with faint ridges, as shown in Fig. 3.

The thorax has two, smooth, disproportionately large, unconsolidated segments, both of which at maturity are greatly excavated posteriorly. These two segments are followed by nine smaller abdominal ones, each of which bears medially a parallel series of linear ridges. These ridges are most prominent posteriorly, and terminate on the lateral extensions of the ninth segment. The tenth, or anal segment, is imperfect. It is grooved medially, and probably had two slender lateral cercopoda, as in *D. carri.*

Length of smallest specimen, not including the cercopoda, 11 mm.; greatest width, 8 mm. Length of largest specimen, which lacks the small abdominal segments, 23 mm.; width across the large anterior segments, 19 mm.

Formation and locality.—In Lower Coal Measure nodules, near Morris, Illinois. Three specimens are known: One, the type, is in the collection of Mr. R. D. Lacoe; another was found by Mr. J. C. Carr, and a third, the most perfect example, by Mr. L. E. Daniels. Specimen No. 25713, U.S.N.M.

DIPLODISCUS CARRI, new species.

(Plate LVIII, fig. 6.)

This species is associated with *D. diplodiscus.* It differs in being considerably narrower, and in having but seven small abdominal segments, three less than in the latter form. Moreover, the segments are broader, and posteriorly do not taper so rapidly, as in *D. diplodiscus.* The anal segment, as far as can be seen, is very wide, deeply grooved, and bears two long, slender cercopoda. These are marked by widely separated transverse lines.

The specimen exposes the dorsal side, but is crushed in along the center through the two large thoracic segments and the head shield. The drawing shows the detail as observed, but the ventral structure can not be made out beyond the fact that the head bears a series of diverging furrows, probably corresponding to five pairs of limbs.

Greatest length not including the cercopoda, 17 mm.; greatest width, 9 mm.

Formation and locality.—A single specimen of this species was found by Mr. J. C. Carr, near Morris, Illinois. The writer takes pleasure in naming the species after its discoverer, in recognition of his intelligent and persistent efforts for many years to unearth the fossil treasures of Mazon Creek.

PROTOCARIS, Walcott.

(Plate LVIII, fig. 1.)

Protocaris, WALCOTT, Bull. U. S. Geol. Surv., No. 10, 1884, p. 50, pl. x, fig. 1; Ibid., No. 30, 1886, p. 147, pl. xv, fig. 1.

Generic characters.—Carapace large, smooth, subquadrangular in outline, posteriorly much extended over the abdomen, slightly excavated medially along the anterior margin and more deeply posteriorly; mar-

gins somewhat thickened; just within the anterior margin, two large nearly circular depressions appear to be present, which may represent eyes. Abdomen tapering slightly, with thirty short, equally broad segments back of the carapace, and a wide anal segment. Cercopoda not long and comparatively thick.

Type.—P. marshii, Walcott. (No. 15400 U.S.N.M.)

The writer is unable to add much to the structure of *Protocaris* as worked out by Mr. Walcott. The obverse and reverse sides of the only specimen show that the abdomen continued beneath the cephalon, as in *Apus*. Therefore many more than thirty segments were present in *P. marshii*. The cercopoda are shorter and thicker than in *Apus* or *Lepidurus*. That eyes are present is not certain, but faint markings exist as indicated in Fig. 1. Theoretically it is probable that eyes are present on the dorsal surface and near the anterior margin of *Protocaris*. The reasons for this are: (1) In the development of trilobites the eyes are known to pass from the ventral to the dorsal side; (2) the ontogeny of *Apus* shows a similar transposition; (3) in the Lower Cambrian nearly all trilobites associated with *Protocaris* have eyes on the dorsal surface; (4) *Protocaris* is clearly one of the Apodidæ, and in this family the eyes are never much removed from the anterior margin. Therefore it is not to be expected that at the very base of the Cambrian the eyes of *Protocaris* would have traveled much back of the anterior margin; (5) in *Dipeltis* of the Carboniferous the eyes are situated as in recent species of the Apodidæ.

Protocaris is a synthetic type, as might be expected of animals occurring at the base of the known fossil-bearing strata. Regarding this fossil, Walcott stated that "this is probably the oldest Phyllopod crustacean known, and that this animal is Apus-like." The numerously segmented abdomen, the presence of cercopoda and a wide anal segment, or telson, and the posterior extension of the carapace over the abdomen clearly indicate that *Protocaris* is nearly related to the Apodidæ. On the other hand, the subquadrangular shield of this genus is quite unlike that in any member of the Apodidæ, and its anterior excavated margin recalls certain Ceratiocaridæ, as *Ceratiocaris*, *Dithyrocaris*, and *Argas*. *Protocaris* differs, however, from these *Phyllocarida* in its Apus-like abdomen.

Since writing the above it has been learned that Clarke and Bernard have reached similar conclusions. The former states:

> Another very early univalved species, not unlike *Nebalia*, but wonderfully similar to the living Phyllopod *Apus*, is the *Protocaris marshii*, Walcott. * * * The single example of *Protocaris* known, has probably been subjected to some horizontal distortion in the shale, giving the carapace a disproportionate size with reference to *Apus*, possibly also serving to obliterate any external evidence of ocular nodes which may have existed, but the remarkable closeness in the form of the abdominal segments, the degree of segmentation, and the single strong pair of caudal processes, render it highly probable that in *Protocaris*, we have to do with an apudiform phyllopod rather than with a nebalioid phyllocarid.[1]

[1] On the structure of the carapace in the Devonian crustacean *Rhinocaris*, by J. M. Clarke, Amer. Nat., 1893, p. 799.

Bernard writes "that animals closely resembling *Apus* were extant in earliest times we now know for certain * * * from the remarkable Cambrian *Protocaris marshii*, which apparently possessed the same peculiar characters of the posterior segmentation as *Apus*, and which I should like to call *Apus marshii*."[1]

The fauna in which *Protocaris* occurs in Georgia, Vermont, is entirely marine, and is associated with characteristic Lower Cambrian trilobites and brachiopods.

GEOLOGICAL HISTORY OF THE APODIDÆ.

Living Apodidæ, although rare, are, however, widely distributed over the continents, generally in fresh-water ponds and pools. Three or four days suffice to develop the nauplius from the egg, which may have lain buried in mud from the previous season.

Fossil Apodidæ are occasionally discovered in fresh-water Tertiary deposits, and before the true systematic position of *Dipeltis* and *Protocaris* was known, no members of this family were believed to exist earlier than the Triassic. Salter[2] mentions a true *Apus* from the Triassic of Europe. Zittel, in his Handbuch der Palæontologie, says that Prestwich described *Apus dubius* from the Coal Measures of England. From Doctor Charles E. Beecher, the writer learns that "*A. dubius* seems to be an abdominal segment or plate of some eurypterid." In *Dipeltis* the family is represented in the Upper Carboniferous, and, although the carapace of *Protocaris* is not entirely Apus-like, there is not much doubt that the genus belongs in the Apodidæ. The history of the family therefore, extends throughout the time represented by the entire known fossil-bearing rocks, as *Protocaris* occurs at the base of the Lower Cambrian.

Since the Apodidæ are generally believed to be of late introduction geologically, the family has been regarded as a highly specialized group, by Salter and Packard. The latter writes:

> In conclusion, therefore, we consider the Phyllopods as a whole, especially the Apodidæ and Branchipodæ, to be a comparatively recent, highly specialized group, which were developed under exceptional biological conditions in bodies of fresh water, and which, as in Apus, show that this branch of the Crustacean genealogical tree has culminated. The irrelative repetition of the segments and appendages (in Apus) gives evidence that the type, so far from being ancestral, is one comparatively modern, specialized, and fully worked out.[3]

In his studies of the Apodidæ, Bernard also recognizes the imperfection of the geological history of the family, but for reasons given, mainly anatomical, concludes that "*Apus* is a very ancient form in spite of the deficiency in its own geological record."[4] In a later paper,[5] he states that *Protocaris marshii* might be called *Apus marshii*, thus recognizing the great geological age of the Apodidæ.

Protocaris and *Dipeltis* inhabited marine waters, while all recent species are denizens of fresh waters, generally of ponds and pools.

[1] Quart. Jour. Geol. Soc. Lond., L, 1894, p. 413.
[2] Quart. Jour. Geol. Soc. Lond., XIX, 1863, pp. 87–92.
[3] Twelfth Ann. Rept. U. S. Geol. Surv. Terr., Pt. 1, 1883, p. 419.
[4] The Apodidæ. A morphological study. Nature series, 1892, p. 182.
[5] Quart. Jour. Geol. Soc. Lond., L. 1894, p. 413.

CLASSIFICATION.

Family APODIDAE, Burmeister (emend after Packard).

"Head and body in front broad and flat, shovel-shaped or subquadrate; carapace broad and flat [usually followed by a cylindrical body or rarely by two large thoracic segments]; the body cylindrical, few or numerous segments extending beyond the carapace; antennæ small, second pair minute, sometimes wanting; labrum large, broad, flat; feet numerous, usually 63 pairs; with a large coxal, maxilla-like basal lobe forming gnathites; beyond five subjointed endites; the 2–4 endites in first pair of feet very long and slender, especially the fifth; gill pear-shaped or bottle-shaped; flabellum triangular, simple; the fifth endite of the first pair of legs is sometimes nearly as long as the body, the eleventh pair bearing egg sacs, and in the male having the genital outlet. Behind the eleventh pair two of the abdominal segments bear each six pairs of appendages, there being many more appendages than segments to the abdomen, while a variable number at the end are without appendages. Telson cylindrical, either short or ending (in *Lepidurus*) in a long paddle-like outgrowth. A pair of [short or] long filiform [or stout] jointed caudal appendages. Larva a nauplius." Cambrian to Recent.

APODINÆ, new subfamily.

Characters of the family as given, omitting the two thoracic segments of the Dipeltinæ. Habitat: Marine and fresh waters. Cambrian to Recent.

Carapace subquadrangular. *Protocaris.*

"Telson ending in a long paddle-shaped outgrowth. *Lepidurus.*
Telson short, cylindrical, simple. *Apus*" (Packard).

DIPELTINÆ, new subfamily.

Like Apodinæ, but with a narrow head shield and two large, free, thoracic segments. Telson apparently not drawn out. Ventral appendages unknown. Habitat: Marine waters. Upper Carboniferous. *Dipeltis.*

EXPLANATION OF PLATE.

PLATE LVIII.

Protocaris marshii, Walcott.

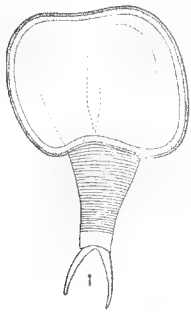
Fig. 1. Lower Cambrian; Swanton, Vt. Natural size.

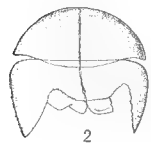
Dipeltis diplodiscus, Packard.

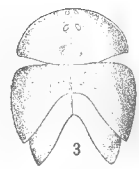
2. Lower Coal Measures; Morris, Ill. View of the type specimen preserving the head shield, the first and portions of the second thoracic segments. Natural size. Lacoe Collection.
3. Specimen showing the complete head shield and the two large segments. Natural size.
4, 5. Reverse and obverse, respectively, of a small, nearly entire specimen. Enlarged three times.

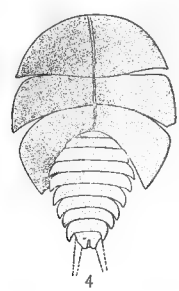
Dipeltis carri, new species.

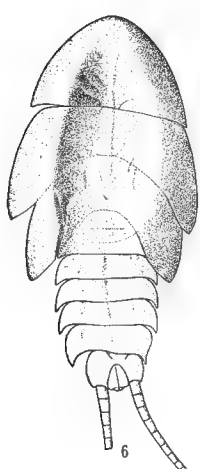
6. Lower Coal Measures; Morris, Ill. The central depression in this specimen is due to crushing. Enlarged three times.

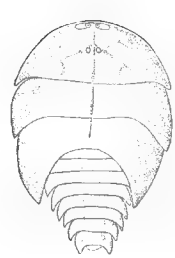












FOSSIL PHYLLOPODS.

FOR EXPLANATION OF PLATE SEE PAGE 676.

CATALOGUE OF A COLLECTION OF BIRDS MADE BY DOCTOR W. L. ABBOTT IN MADAGASCAR, WITH DESCRIPTIONS OF THREE NEW SPECIES.

By Charles W. Richmond,
Assistant Curator, Department of Birds.

Within the last few months Doctor Abbott has forwarded to the United States National Museum another of his interesting collections, consisting of mammals, birds, ethnological material, and miscellaneous objects of natural history from Madagascar. In so far as the birds are concerned, this collection contains 217 specimens and 83 species, of which three appear to be new to science. One of the latter has been described in another connection,[1] and the other two are characterized in the accompanying catalogue.

The birds are very well prepared, as usual, fresh in appearance, and a number of the species are rare and of great interest.

On account of the unsettled condition of affairs in the island, Doctor Abbott was unable to procure any ammunition there or to have it sent him from African ports, and was thus obliged to discontinue his explorations, leaving the most attractive regions, the south and southwest, unvisited.

After a few months, February to July, 1895, spent in Madagascar, mainly on the east coast, Doctor Abbott returned to Kashmir, where he spent the winter, chiefly in the pursuit of large game and such material as he had not previously sent from that region.

Most of the references in the synonymy of the list have been carefully verified, with the result that in several cases they differ from the references in the British Museum catalogues.

Family COLYMBIDÆ.

1. COLYMBUS PELZELNII (Hartlaub).

P[odiceps] pelzelnii, Hartlaub, Fauna Madag., 1861, p. 83. (Madagascar.)

One specimen. Male adult, north of River Mangoro, May 8.

[1] Proc. Biol. Soc., Wash., X, March 14, 1896, p. 53.

Family LARIDÆ.

2. ? STERNA MEDIA, Horsfield.

Sterna media, HORSFIELD, Trans. Linn. Soc. Lond., XIII, 1820, p. 199. (Java.)

One specimen. Male adult, River Sakalés, east coast, May 13. This is the same as the species recently recorded by Mr. Ridgway from Gloriosa Island.[1]

Family PROCELLARIIDÆ.

3. DAPTION CAPENSIS (Linnæus).

[*Procellaria*] *capensis*, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 132. (Cape of Good Hope.)

Daption capenses, STEPHENS, Shaw's Gen. Zool., XIII, Pt. 1, 1825, p. 241.

One specimen. Female adult, Mananjara, east coast, June 29.

Family ANATIDÆ.

4. PÆCILONITTA ERYTHRORHYNCHA (Gmelin).

[*Anas*] *erythrorhyncha*, GMELIN, Syst. Nat., I, Pt. 2, 1788, p. 517. (Cape of Good Hope.)

Pœcilonitta erythrorhyncha, EYTON, Monogr. Anat., 1838, p. 115.

Four specimens. Male adult, Namorona, east coast, June 3. Female adult, Namorona, June 3. Male adult, Faraony River, east coast, June 6. Female adult, Namorona River, east coast, June 25.

5. THALASSORNIS INSULARIS, new species.

Type.—No. 151139, U.S.N.M.; male adult, River Sakalés, east coast of Madagascar, May 15, 1895; collected by Doctor W. L. Abbott.

Similar to *Thalassornis leuconota*, of Africa, but much smaller; crown more intense black; abdomen darker; tail feathers darker and decidedly narrower; black markings everywhere more intense; buff color of sides of head, neck, and breast paler and grayer. The following measurements of a pair, obtained May 15, compared with a pair of *T. leuconota* collected by Doctor Abbott in Africa, May 10, 1889, will emphasize the differences in size:

Measurements of Thalassornis insularis and T. leuconota.

U.S.N.M. number.	Sex.	Locality.	Date.	Wing.	Tail.	Tarsus.	Culmen.	Depth of bill at the base.
				Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
151139	Male	River Sakalés, Madagascar.	May 15	5.55	1.88	1.27	1.36	0.70
151138	Female	do	do	5.30	1.90	1.28	1.30	.67
117774	Male	Plains southwest of Kilimanjaro, Africa.	May 10	6.25	2.11	1.54	1.49	.78
117775	Female	do	do	6.10	2.17	1.47	1.45	.77

The name *Anas brevipennis*, of Lichtenstein, may possibly refer to this species, but I am not aware that any description was ever published.

[1] Proc. U. S. Nat. Mus., XVIII, No. 1079, p. 524.

6. NETTAPUS AURITUS (Boddaert).

Anas aurita, BODDAERT, Tabl. Plan. Enlum., 1783, p. 48. (Madagascar.)
N[ettapus] auritus, G. R. GRAY, List Gen. Birds, 1840, p. 73.

Three specimens. Male adult, River Sakalés, east coast, May 13. Two specimens. Female adult, same locality, May 15.

Family SCOPIDÆ.

7. SCOPUS UMBRETTA, Gmelin.

[*Scopus*] *umbretta*, GMELIN, Syst. Nat., I, Pt. 2, 1788, p. 618. (Africa.)

Two specimens. Female adult, River Faraony, east coast, June 5. Female adult, Ambodiasy, River Faraony, June 12.

Family ARDEIDÆ.

8. BUTORIDES ATRICAPILLA (Afzelius).

Ardea atricapilla, AFZELIUS, Vet. Acad. Handl., 1804, p. 264. (Sierra Leone.)
[*Butorides*] *atricapilla*, BONAPARTE, Consp. Avium, II, 1855, p. 129.

Three specimens. Female immature, Mahanoro, May 3. Male immature, Lohóloka, east coast, June 24. Female adult, Mananjara, July 3.

9. DEMIGRETTA GULARIS (Bosc).

Ardea gularis, BOSC, Actes Soc. Hist. Nat. Paris, I, 1792, p. 4.
D[emiegretta] gularis, WALDEN, Ibis, 1873, p. 320.

One specimen. Male adult, River Namorona, east coast, June 25.

10. ARDEOLA RALLOIDES (Scopoli).

Ardea ralloides, SCOPOLI, Ann. I. Hist. Nat., 1769, p. 88.
[*Ardeola*] *ralloides*, BOIE, Isis, 1822, p. 559.

One specimen. Male immature, Mananjara, July 4.

11. BUBULCUS IBIS (Linnæus).

[*Ardea*] *ibis*, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 144. (Egypt.)
[*Bubulcus*] *ibis*, BONAPARTE, Consp. Avium, II, 1855, p. 125.

One specimen. Male adult, Ambodinivongo, Ankay Valley, March 29.

12. ARDEA CINEREA, Linnæus.

[*Ardea*] *cinerea*, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 143. (Europe.)

One specimen. Male adult, Vohimaso, River Faraony, east coast, June 23. "Length, 43 inches."

13. ARDEA PURPUREA, Linnæus.

[*Ardea*] *purpurea*, LINNÆUS, Syst. Nat., 12th ed., I, 1766, p. 236.

Two specimens. Immature, River Sakalés, east coast, May 15. Female immature, Marohita, east coast, June 2. "Length, 38½ inches;

bill black above, greenish yellow beneath; feet, tarsi, and upper surface of toes black; tarsi behind and under surface of toes greenish yellow; irides yellow."

14. HERODIAS INTERMEDIA (Wagler).

A[rdea] intermedia, WAGLER, Isis, 1829, p. 659. (Java.)
H[erodias] intermedia, BLYTH, Cat. Birds Mus. Asiat. Soc., 1849, p. 279.

One specimen. Female adult, River Faraony, east coast, June 6.

Family RALLIDÆ.

15. RALLUS CUVIERI, Pucheran.

Rallus cuvieri, PUCHERAN, Rev. et Mag. Zool., 1845, p. 279.

Two specimens. Female adult, River Sakalés, east coast, May 13. "Length, 13 inches." Male adult, Marohita, east coast, June 27. "Bill dull black, base of lower mandible livid purple; feet blackish brown; irides chestnut brown; length, 13¾ inches; extent, 19 inches."

16. PORPHYRIO PORPHYRIO (Linnæus).

[*Fulica*] *porphyrio*, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 152.
Porphyrio porphyrio, SHARPE, Cat. Birds Brit. Mus., XXIII, 1894, p. 195.

Two specimens. Female adult, River Sakalés, east coast, May 15. Female adult, Marohita, east coast, June 26.

17. GALLINULA PYRRHORRHOA, A. Newton.

Gallinula pyrrhorrhoa, A. NEWTON, Proc. Zool. Soc. Lond., 1861, p. 19. (Mauritius.)

Two specimens. Male, adult, Mahanoro, April 26. Male adult, River Sakalés, east coast, May 13.

Family RECURVIROSTRIDÆ.

18. HIMANTOPUS HIMANTOPUS (Linnæus).

[*Charadrius*] *himantopus*, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 151. (Southern Europe.)
"*Himantopus himantopus*, BRUSINA."

Three specimens. Male adult, River Faraony, east coast, June 6. Female adult, same date and locality. Male adult, same locality, June 24. The tarsus in these examples appears to be a trifle shorter than in northern birds.

Family CHARADRIIDÆ.

19. ÆGIALITIS BIFRONTATA (Cabanis).

Charadrius (*Aegialites*) *bifrontatus*, CABANIS, Ornith. Centralbl., 1882, p. 14. (Madagascar.)

One specimen. Female adult, Vatomasa, River Faraony, east coast, June 24. "Bill fleshy at base, tip black; feet fleshy, claws black; irides pale brown; orbits bright red."

20. ÆGIALITIS TENELLA (Hartlaub).

Ch[aradrius] tenellus, HARTLAUB, Fauna Madag., 1861, p. 72. (Madagascar.)
Ægialitis tenellus, SHELLEY, Ibis, 1888, p. 305.

Four specimens. Male adult, River Sakalés, May 13. Female adult, Mananjara, east coast, May 28. "Bill black; legs dusky flesh color; toes black." Male adult, Mananjara, May 29. Male adult, Lohóloka, east coast, June 24.

The legs and feet in these specimens are dark; not yellow, as shown in Seebohm's plate.[1]

21. ÆGIALITIS VARIA (Vieillot).

Charadrius varius, VIEILLOT, Nouv. Dict., XXVII, 1818, p. 143. (Africa.)
Ægialitis varius, HARTING, Ibis, 1873, p. 261.

One specimen. Female adult, Lohóloka, east coast, June 3.

22. ÆGIALITIS THORACICA, Richmond.

Ægialitis thoracica, RICHMOND, Proc. Biol. Soc. Wash., X, 1896, p. 53 (March 14). (East coast Madagascar.)

Three specimens. Female adult, mouth of river Fanantara, east coast, May 18. Female adult, Lohóloka, east coast, June 3. Two specimens.

The description of this species is here repeated for the benefit of those who are unable to consult the original.

Type.—Female adult, 151174, U.S.N.M., Lohóloka, east coast of Madagascar, June 3, 1895. Doctor W. L. Abbott, collector.

Crown, back, scapulars, tertials, and wing-coverts hair brown, the feathers edged with pale or deep buff, those of the greater wing-coverts edged and tipped with white; primaries, secondaries, rump, median upper tail-coverts, and middle rectrices dark clove brown; shafts of primaries (including the third) with white on terminal half; primary coverts brownish black, tipped with white; lateral upper tail-coverts white; inner primaries narrowly bordered on inner web and tipped with white; base of outer webs white; secondaries tipped with white, which becomes broader toward the innermost. Forehead, lores, cheeks, throat, axillars, under wing coverts, sides of body, and flanks white; a line from upper mandible to lower anterior border of eye, continued posteriorly through and including ear-coverts, black, meeting a narrower black band extending across lower border of nape, and a broad black pectoral band, the latter more extensive on sides of chest; an interocular crescent-shaped black band borders the white forehead and separates it from a white line over eyes, ear-coverts, and passing across nape as a conspicuous nuchal band (leaving the dark crown patch entirely surrounded by a white ring, and the latter isolated from other white markings); a white band below the black pectoral one passes abruptly into cinnamon buff on the abdomen and under tail-coverts, that of the former extending up on sides of body to the black pectoral band,

[1] Geogr. Distrib. Charad., pl. VII.

intercepting the white. Three outer tail feathers white, with more or less dusky markings, especially on the two inner ones; next inner pair (fourth) dusky, with white tips; fifth pair hair brown, becoming black subterminally, with a deep buff tip. Bill, legs, and feet black in dried skin. Wing, 4 inches; tail, 1.72; tarsus, 1.20; exposed culmen, 0.69. In another female the wing measures 4.20 inches.

This species is apparently most nearly related to *E. varia* of Africa and Madagascar, but differs from it mainly in the presence of a black pectoral band and the absence of a wholly black shaft in the third primary; the white line posterior to the black crescent between eyes is more pronounced, and the lesser wing-coverts and primary coverts are not decidedly blackish. There is also a slight difference in size. *E. thoracica* has heretofore been identified with *E. varia* by the French authors, the explanation being that the adults have a black chest band not present in the younger birds, but it is also admitted that black-chested birds have not been found in Africa. Both species are apparently found together on the east coast of Madagascar, where, at Lohóloka, on June 3, Doctor Abbott obtained a specimen of each.

Family JACANIDÆ.

23. PHYLLOPEZUS ALBINUCA (St. Hilaire).

P[arra] albinuca, St. Hilaire, Mag. Zool., 1832, pl. vi. (Madagascar.)
[*Phyllopezus*] *albinucha*, Shelley, Birds Africa, 1896, p. 187.

Three specimens. Male adult, Mahanoro, April 26. Female adult, same locality and date. Two specimens.

Family PHASIANIDÆ.

24. MARGAROPERDIX MADAGARENSIS (Scopoli).

Tetrao (madagarensis), Scopoli, Del. Flor. et Faun. Insubr., Pt. 2, 1786, p. 93. [Madagascar.]
Margaroperdix madagascariensis, Hartert, Kat. Mus. Senckenb., 1891, p. 195.

Two specimens. Male adult, Andrangolsaka, Imerina, March 28. Male adult, 30 miles northwest of Mahanoro, April 18. "Length, $10\frac{3}{4}$ inches."

25. NUMIDA MITRATA, Pallas.

Numida mitrata, Pallas, Spic. Zool., I, Pt. 4, 1767, p. 18.

One specimen. Male adult, Mahanoro, May 30.

Family TURNICIDÆ.

26. TURNIX NIGRICOLLIS (Gmelin).

[*Tetrao*] *nigricollis*, Gmelin, Syst. Nat., I, Pt. 2, 1788, p. 767. (Madagascar.)
Turnix nigricollis, Vieillot, Nouv. Dict., XXXV, 1819, p. 45.

Four specimens. Male adult, Andrangolsaka, Imerina, March 27. Female adult, Mahanoro, May 1, 2. Two specimens. Female adult, Masomeloka, east coast, May 9.

Family TRERONIDÆ.

27. VINAGO AUSTRALIS (Linnæus).

[*Columba*] *australis*, LINNÆUS, Mantiss., 1771, p. 526. (Madagascar.)
[*Vinago*] *australis*, CUVIER, Règne Animal, I, 1817, p. 457.

Four specimens. Female adult, Mahanoro, May 1. Male adult, Mananjara, east coast, May 19. "Irides blue, feet yellow." Two specimens. Female adult, same locality and date.

28. ALECTRŒNAS MADAGASCARIENSIS (Linnæus).

[*Columba*] *madagascariensis*, LINNÆUS, Syst. Nat., 12th ed., I, 1766, p. 283. (Madagascar.)
Alectrœnas madagascariensis, REICHENBACH, Syn. Av., Columbariæ, 1847, p. 2.

Two specimens. Male adult, valley of River Faraony, east coast, June 8. Male adult, Ambodiasy, valley of River Faraony, June 14.

Family COLUMBIDÆ.

29. TURTUR PICTURATUS (Temminck).

Columba picturata, TEMMINCK, Pig. et Gallin., I, 1813, pp. 315, 480. (Ile de France.)
T[urtur] picturatus, BLYTH, Cat. Birds Mus. Asiat. Soc., 1849, p. 236.

Six specimens. Female adult, Mahanoro, May 1, 2. Three specimens. Male adult, Mananjara, east coast, May 25. Male adult, Ambodiasy, valley of River Faraony, east coast, June 16, 20. Two specimens.

Family FALCONIDÆ.

30. MILVUS AEGYPTIUS (Gmelin).

[*Falco*] *aegyptius*, GMELIN, Syst. Nat., I, Pt. 1, 1788, p. 261. (Egypt.)
Milvus ægyptius, J. E. GRAY, List Birds Brit. Mus., I, Accipitres, 1848, p. 44.

One specimen. Male adult, River Faraony, east coast, June 5.

31. ACCIPITER MADAGASCARIENSIS, Verreaux.

Accipiter madagascariensis, J. VERREAUX, S. Afr. Q. Journ., 1833, p. 80. (Madagascar.)

One specimen. Female adult, valley of River Faraony, east coast, June 9. "Length, 15¼ inches." In this example the under tail coverts are barred.

32. ACCIPITER FRANCESII, Smith.

Accipiter francesii, SMITH, S. Afr. Q. Journ., II, 1834, p. 280. (Madagascar.)

Five specimens. Female immature, River Faraony, east coast, June 4, 7. Three specimens. Male immature, same locality, June 21. Female immature, Vohimaso, River Faraony, June 22. "Bill horn blue, tip black, cere greenish yellow; feet yellow, claws black; irides golden yellow; length, 12¼ inches."

All of these specimens are in the immature plumage, with barred under parts, but there is much individual variation shown among them. Two, a male and female, are apparently younger than the others, and have a fulvous tinge on the light markings of the under parts, inner webs of tail feathers, and under side of wings; the throat pale buff, with longitudinal spots and streaks of dark brown, instead of white with fine gray transverse bars. The bars on the under parts of these younger birds are also broader, browner, and with wider interspaces than in the others; the upper parts are browner, without any slate color on the head. There is also a superciliary stripe of mixed buff and brown.

33. BUTEO BRACHYPTERUS, Hartlaub.

B[uteo] brachypterus "v. Pelz.," HARTLAUB, Fauna Madag., 1861, p. 15. (Madagascar.)

Four specimens. Female adult, 80 miles northwest of Mahanoro, April 5. "Length, 19¼ inches. Crop contained a rat." Male adult, Namorona, east coast, June 3. Female adult, River Faraony, east coast, June 5. Male adult, same locality, June 6.

34. FALCO MINOR, Bonaparte.

Falco minor, BONAPARTE, Rev. et Mag. Zool., 1850, p. 484. (Cape of Good Hope.)

Two specimens. Male adult, Ambodivongo, Ankay, March 30. Female adult, Marohita, near Mananjara, east coast, June 27. "Bill horny black at tip; base of lower mandible greenish yellow; cere greenish yellow; feet lemon yellow, claws black; irides dark brown; length, 19¼ inches."

Captain Shelley does not include Madagascar in the range of this species, although it has been recorded from there on more than one occasion.

35 FALCO NEWTONI (Gurney).

Tinnunculus newtoni, GURNEY, Ibis, 1863, p. 34. (Madagascar.)
Falco newtoni, SCHLEGEL, Proc. Zool. Soc. Lond., 1866, p. 420.

Five specimens. Male adult, Antananarivo, February 8 (rufous phase). Female adult, Andrangolsaka, Imerina, March 25. "Length, 11½ inches." Female adult, same locality, March 26. Female immature, Ambodivongo, Ankay Valley, March 30. "Length, 11⅛ inches." Female adult, 60 miles northwest of Mahanoro, April 12 (rufous phase). No two of these specimens are exactly alike, but one pair are in the rufous and the others in the light phase. Of the latter, two appear to be fully adult, while the third is an immature bird, with broad black bars on the back, buffy tips on the primaries, secondaries, greater wing-coverts, and primary coverts; upper tail-coverts barred with rufous and black; under parts, nape, and sides of head tinged with light fulvous. It is beginning to molt, and two or three gray and black feathers appear on the upper tail-coverts; on the back a few dark rufous feathers, with small black shaft spots, are replacing the broad-

barred feathers of the worn plumage. From an inspection of this series it is difficult to believe the dark rufous phase represents the immature birds, and the light one adults; I am inclined, on the other hand, to think that this species has two phases of plumage, independent of age, sex, or season; a dark rufous one, and a light one with whitish under parts, with white, spotted under wing-coverts.

36. POLYBOROIDES RADIATUS (Scopoli).

Vultur (radiatus), SCOPOLI, Del. Faun. et Flor. Insubr., II, 1786, p. 85. (Madagascar.)
P[olyboroides] radiatus, G. R. GRAY, List Gen. Birds, 1840, p. 5.

Five specimens. Male adult, Andrangolsaka, Imerina, March 29. Female adult, 60 miles northwest of Mahanoro, April 5. Male immature, Mahanoro, May 1. Female immature, Ambodiasy, River Faraony, June 12. Male adult, River Faraony, east coast, June 21.

Family STRIGIDÆ.

37. STRIX ALUCO, Linnæus.

[*Strix*] *aluco*, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 93. (Europe.)

One specimen. Male adult, River Faraony, east coast, June 21. Not typical *S. aluco*, but just what name it should bear I am not now able to say.

Family PSITTACIDÆ.

38. CORACOPSIS VASA (Shaw).

Psittacus vasa, SHAW, Gen. Zool., VIII, Pt. 2, 1811, p. 528. [Madagascar.]
C[oracopsis] vasa, BONAPARTE, Consp. Avium, I, 1850, p. 7.

Three specimens. Female adult, Mangoro River, April 2. Male adult, valley of River Faraony, east coast, June 9. "Length, 19½ inches." Female adult, Ambodiasy, valley of Faraony, June 20.

39. CORACOPSIS NIGRA (Linnæus).

[*Psittacus*] *niger*, LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 99. (Madagascar.)
C[oracopsis] nigra, WAGLER, Monogr. Psitt., 1832, p. 680.

Four specimens. Male adult, Mahatsara, River Mangoro, April 1. Male adult, 50 miles northwest of Mahanoro, April 13. Female adult, River Sakalés, east coast, May 16. Female adult, Ambodiasy, valley of Faraony, June 15.

40. AGAPORNIS MADAGASCARIENSIS (Boddaert).

Psittacula madagascariensis, BODDAERT (*ex* BRISSON), Tabl. Plan. Enlum., 1783, p. 49. (Madagascar.)
Agapornis madagascariensis, SIBREE, Ibis, 1891, p. 214.

Three specimens. Female adult, 60 miles northwest of Mahanoro, April 12. Male adult, Mahanoro, May 1. Female adult, Mahanoro, May 2.

Family CUCULIDÆ.

41. CUCULUS ROCHII, Hartlaub.

Cuculus rochii, HARTLAUB, Proc. Zool. Soc. Lond., 1862, p. 224. (Madagascar.)

One specimen. Male immature, 50 miles northwest of Mahanoro, April 16.

42. CENTROPUS TOULOU (Müller).

Cuculus toulou, MÜLLER, Syst. Nat., Suppl., 1776, p. 90. (Madagascar.)
Centropus toulu, ILLIGER, Abhandl. k. Akad. Wiss. Berlin, 1816, p. 224.

Four specimens. Male immature, Andrangolsaka, Imerina, March 26. "Length, 16½ inches; irides brown." Male adult, 50 miles northwest of Mahanoro, April 14. Female adult. Mahanoro, May 1. Female adult, Mananjara, July 3.

43. COUA CÆRULEA (Linnæus).

[*Cuculus*] *cæruleus*, LINNÆUS, Syst. Nat., 12th ed., I, 1766, p. 171. (Madagascar.)
C[*oua*] *cærulea*, G. R. GRAY, Gen. Birds, II, 1846, p. 454.

Three specimens. Male adult, 60 miles northwest of Mahanoro, April 6. Male adult, same locality, April 12. Female adult, Ambodiasy, valley of Faraony, June 20.

44. COUA REYNAUDII, Pucheran.

Coua reynaudii, PUCHERAN, Rev. Zool., 1845, p. 51.

One specimen. Male adult, 80 miles northwest of Mahanoro, April 5.

45. COUA CRISTATA (Linnæus).

[*Cuculus*] *cristatus*, LINNÆUS, Syst. Nat., 12th ed., I, 1766, p. 171. (Madagascar.)
C[*oua*] *cristata*, G. R. GRAY, Gen. Birds, II, 1846, p. 454.

Two specimens. Male adult, Mahanoro, May 9. Male adult, River Sakalés, east coast, May 16.

Family CAPRIMULGIDÆ.

46. CAPRIMULGUS MADAGASCARIENSIS, Sganzin.

Caprimulgus madagascariensis, SGANZIN, Mem. Soc. Hist. Nat. Strasb., 1840, p. 28. (Madagascar.)

Three specimens. Male adult, Mananjara, east coast, May 26. Female adult, same locality and date. Immature, Ambodiasy, valley of Faraony, east coast, June 13.

Family CORACIIDÆ.

47. EURYSTOMUS GLAUCURUS (Müller).

Coracias glaucurus, MÜLLER, Syst. Nat., Suppl., 1776, p. 86. (Madagascar.)
[*Eurystomus*] *glaucurus*, G. R. GRAY, Hand-list Birds, I, 1869, p. 76.

Two specimens. Female adult, Andrangolsaka, Imerina, March 27; 4,500 feet. Female adult, 60 miles northwest of Mahanoro, April 11.

Family LEPTOSOMATIDÆ.

48. LEPTOSOMUS DISCOLOR (Hermann).

Cuculus discolor, HERMANN, Tabl. Affin. Anim., 1777, p. 186. (Madagascar.)
L[eptosomus] discolor, CABANIS and HEINE, Mus. Hein., IV, Pt. 1, 1862, p. 57.

One specimen. Female adult, 60 miles northwest of Mahanoro, April 11.

Family MEROPIDÆ.

49. MEROPS SUPERCILIOSUS, Linnæus.

[*Merops*] *superciliosus*, LINNÆUS, Syst. Nat., 12th ed., I, 1766, p. 183. (Madagascar.)

Two specimens. Male adult, 50 miles northwest of Mahanoro, April 13. "Bill black; irides dark red; length, $10\frac{3}{4}$ inches." Female adult, Mahanoro, May 1.

Family ALCEDINIDÆ.

50. CORYTHORNIS CRISTATA (Linnæus).

[*Alcedo*] *cristata*, LINNÆUS, Syst. Nat., 12th ed., I, 1766, p. 178. [Madagascar.]
Corythornis cristata, SHARPE, Proc. Zool. Soc. Lond., 1870, p. 398.

Four specimens. Female adult, Mahanoro, April 26. Male adult. Mananjara, east coast, July 3. Three specimens.

Family MICROPODIDÆ.

51. TACHORNIS GRACILIS (Sharpe).

Cypselus gracilis, SHARPE, Proc. Zool. Soc. Lond., 1871, p. 315. (Madagascar.)
Tachornis gracilis, HARTERT, Cat. Birds Brit. Mus., XVI, 1892, p. 464.

Three specimens. Male immature, Mahanoro, May 7. Male adult, Masomeloka, May 9. Two specimens.

Family PHILEPITTIDÆ.

52. PHILEPITTA CASTANEA (Müller).

Turdus castaneus, MÜLLER, Syst. Nat., Suppl., 1776, p. 143. (Madagascar.)
[*Philepitta*] *castanea*, G. R. GRAY, Hand-list Birds, I, 1869, p. 297.

Two specimens. Male immature, River Mangoro, April 2. Male adult, Ambodiasy, valley of Faraony, June 17.

The latter is in slightly worn dress, velvety black, with yellow edges to the feathers of lower breast, abdomen, rump, and crown, with traces on tertiaries, wing-coverts, and some other parts of the plumage. The fleshy lobes are well developed. In the specimen called immature male, the plumage is fresh, and the molt not quite completed. The color is velvety black, but almost every feather on the bird is more or less strongly edged with yellow, this so marked on the abdomen as to almost entirely obscure the black. There are no prominent fleshy

lobes, but a close examination reveals the anterior and posterior horns making their appearance. Scattered over the upper back, head, and sides of neck are a few worn olive-green feathers not yet molted, and two secondaries in each wing are olive-green, similar to those of the female. Another adult male in very worn plumage, in the National Museum collection, shot in January, is practically black, with very slight traces of yellow edges on the feathers of the forehead, under wing-coverts, and sides of body. With these three males before me I would argue that the yellow tips or edges of the feathers are *not* signs of immaturity, as supposed by Doctors Sclater, Sharpe, and others. Unless *Philepitta* is very extraordinary in its manner of molting we would expect the changes to be about as follows: First a nestling plumage, succeeded, in the case of the male, by a plumage very much like, if not identical with, that of the female. This would be the *immature* plumage. At the next molt the adult black livery would be assumed, all the feathers edged with yellow, and the fleshy ornaments over the eyes would put forth. As the plumage becomes worn, and the yellow edges disappear to a great extent, we have the "adult" plumage. According to this theory we would find the old birds in "immature" plumage immediately after every succeeding molt. I should like to see adult birds in molting condition, with new feathers lacking the yellow edges.

Family ALAUDIDÆ.

53. MIRAFRA HOVA, Hartlaub.

M[iraffra] hova, HARTLAUB, Jour. für Orn., 1860, p. 106. (St. Augustin Bay, Madagascar.)

Three specimens. Male adult, Andrangolsaka, Imerina, March 26, 27. Two specimens. Male young, Lohóloka, east coast, June 24.

Family MOTACILLIDÆ.

54. MOTACILLA FLAVIVENTRIS, Hartlaub.

M[otacilla] flaviventris, HARTLAUB (*ex* VERREAUX), Jour. für Orn., 1860, p. 94. (Madagascar.)

Two specimens. Female adult, Mahanoro, April 29. Male adult, Lohóloka, east coast, June 24.

Family TIMALIIDÆ.

55. COPSYCHUS INEXSPECTATUS, new species.

Type.—Male adult, No. 151279, U.S.N.M., mouth of River Fanantara, east coast of Madagascar, May 18, 1895; Doctor W. L. Abbott, collector. Upper parts, chin, throat, breast, and sides of body, glossy blue black; abdomen and under tail-coverts pure white; thighs black, the feathers tipped with white; tail and wings black, with a slight greenish gloss,

the feathers narrowly edged on outer webs with glossy blue black; outer lesser and middle wing-coverts glossy blue black; greater wing-coverts and primary coverts black, with a greenish gloss; inner wing-coverts white, forming a prominent white patch; innermost secondary conspicuously edged with white on outer web; under wing-coverts and axillaries mottled black and white; edge of wing glossy blue black; legs and feet dark plumbeous (in dried skin), claws lighter. Wing, 2.82 inches; tail, 2.65; tarsus, 1.05; culmen, 0.60. The female seems to differ from the description of *C. albo-specularis*, mainly in having the chin and breast gray, like the throat. The gray of chin and throat is somewhat lighter than that of the breast; the abdomen is white. Doctor Abbott notes on the label of one of the females, "bill black; feet leaden blue."

This species is doubtless closely related to *C. albo-specularis*, but the pure white abdomen and under tail-coverts of the male will at once distinguish it from that species. Of the three males sent, the type only is fully adult. One of the others is nearly so; its wings are black without any brownish edging, but the sides of body are sooty gray, with a blackish wash pervading the feathers; the under tail-coverts and a few feathers of the sides are fulvous. The rest of the plumage is exactly that of the adult.

The remaining male is still younger; the sides are lighter, brownish gray; the wing feathers are dark brown, with broad russet edgings on the outer webs of some of the primaries, and narrower, brownish edgings on the rest of the wing feathers; the glossy feathers of the rump are tipped with rusty; the tail feathers are brownish black. In other respects this example is like the adult.

In the only two examples of *C. albo-specularis* accessible to me, both males, the plumage is apparently not quite adult; the feathers on the abdomen, wings, tail, and under tail-coverts are more or less tipped or edged with rusty brown, evidently a sign of immaturity, but there is no white on the abdomen, which, in the species just described, is as prominent and extensive in the immature as in the adult.

The localities represented by the five specimens sent by Doctor Abbott are: Mouth of river Fanantara and Mahela; Mananjara; and Ambodiasy, valley of the Faraony, all on the east coast.

To those who recognize *Gervaisia* as a genus, the species will of course stand as *Gervaisia inexspectata*.

56. HYPSIPETÈS MADAGASCARIENSIS (Müller).

Turdus madagascariensis, MÜLLER, Syst. Nat., Suppl., 1776, p. 139. (Madagascar.)
Hypsipetes madagascariensis, SCHLEGEL, Proc. Zool. Soc. Lond., 1866, p. 422.

Three specimens. Male adult, Andrangolsaka, Imerina, March 26. "Length, 9¾ inches." Female adult, same locality and date. "Length, 9½ inches." Female adult, 40 miles northwest of Mahanoro, April 17.

57. TYLAS EDUARDI, Hartlaub.

Tylas eduardi, HARTLAUB, Proc. Zool. Soc. Lond., 1862, p. 152. (Madagascar.)

Two specimens. Male adult, Andrangolsaka, Imerina, March 26. Male immature, same locality, March 27. "Bill black; irides pale yellow brown."

The adult has a white chest and under tail-coverts, and the rest of the under parts are so pale, with a normally colored feather here and there, that a little bleaching would transform it into a typical *T. alfredi*. The mantle is quite bluish slate. The other specimen is a true *T. eduardi*. and was obtained at the same place a day later.

58. BERNIERIA MADAGASCARIENSIS (Gmelin).

[*Muscicapa*] *madagascariensis*, GMELIN, Syst. Nat., I, Pt. 2, 1788, p. 940. (Madagascar.)

B[*ernieria*] *madagascariensis*, HARTLAUB, Fauna Madag., 1861, p. 53.

One specimen. Female adult, 80 miles northwest of Mahanoro, April 5.

59. BERNIERIA ZOSTEROPS, Sharpe.

Bernieria zosterops, SHARPE, Proc. Zool. Soc. Lond., 1875, p. 76. (Central Madagascar.)

Two specimens. Male adult, 60 miles northwest of Mahanoro, April 6.

Family MUSCICAPIDÆ.

60. PRATINCOLA SIBILLA (Linnæus).

[*Motacilla*] *sibilla*, LINNÆUS, Syst. Nat., 12th ed., I, 1766, p. 337. (Madagascar.)

[*Pratincola*] *sybilla*, BONAPARTE, Consp. Avium., I, 1850, p. 304.

Three specimens. Male adult, Andrangolsaka, Imerina, March 25, 27; 4,500 feet. Two specimens. Female adult, same locality, March 25.

61. NEWTONIA BRUNNEICAUDA (A. Newton).

Erythrosterna (?) *brunneicauda*, A. NEWTON, Proc. Zool. Soc. Lond., 1863, p. 180. (Near Fenerive, Madagascar.)

Newtonia brunneicauda, SCHLEGEL, Proc. Zool. Soc. Lond., 1866, p. 422.

Five specimens. Male adult, Andrangolsaka, Imerina, March 26. Male adult, 80 miles northwest of Mahanoro, April 5. Female adult, 60 miles northwest of Mahanoro, April 6. Female adult, River Sakalés, east coast, May 16. Male adult, Ambodiasy, valley of Faraony, east coast, June 13. "Bill black; feet fleshy brown; irides pale yellow white."

These specimens are all *N. brunneicauda*, but I find a specimen of Reichenow's recently described *N. amphichroa* in the United States National Museum, collected by Reverend W. Dean Cowan, at Ankafana, March 8, 1881.

Doctor J. Büttikofer appears to have redescribed this latter species under the name *Newtonia olivacea*.[1]

[1] Notes Leyden Mus., XVIII p. 199.,

62. TERPSIPHONE MUTATA (Linnæus).

[*Muscicapa*] *mutata*, LINNÆUS, Syst. Nat., 12th ed., I, 1766, p. 325. (Madagascar.)
Terpsiphone mutata, FINSCH and HARTLAUB, Vög. Ostafr., 1870, p. 306.

Four specimens. Male immature, Ambodivongo, Ankay Valley, March 30. Male adult, Mahanoro, May 9. Male immature, Mananjara, east coast, May 28. Female adult, Ambodiasy, valley of Faraony, east coast, June 14.

Family TURDIDÆ.

63. ELLISIA TYPICA, Hartlaub.

E[*llisia*] *typica*, HARTLAUB, Jour. für Orn., 1860, p. 92. (Madagascar.)

Five specimens. Female adult, Andrangolsaka, Imerina, March 27. Female adult, Ambodivongo, Ankay, March 30. Male adult, same locality and date. Female adult, 60 miles northwest of Mahanoro, April 7. "Feet leaden; irides brown; upper mandible black; lower mandible pale brownish flesh; length, 7 inches." Female, river Sakalés, east coast, May 14.

64. EROESSA TENELLA, Hartlaub.

Eroessa tenella, HARTLAUB, Proc. Zool. Soc. Lond., 1866, p. 219. (Madagascar.)

Three specimens. Female adult, Mahanoro, April 29. Male adult, river Sakalés, east coast, May 11. Adult, same locality and date.

65. EROESSA VIRIDIS, Sharpe.

Eroessa viridis, SHARPE, Cat. Birds Brit. Mus., VII, 1883, p. 152. (Ankafana, Betsileo, Madagascar.)

One specimen. Adult, Mahatsara, River Mangoro, April 3.

66. CISTICOLA CHERINA (Smith).

Drymoica cherina, SMITH, Illus. Zool. S. Afr., Aves, 1843, pl. LXXVII, fig. 2. [Madagascar.]
Cisticola cherina, SHARPE, Layard's Birds S. Afr., 2d ed., 1876, p. 278.

Five specimens. Female immature, Andrangolsaka, Imerina, March 25; 4,800 feet. Male adult, same locality and date. Female adult, same locality and date. Female immature, same locality and date. Female adult, Faraony River, east coast, June 5.

Family HIRUNDINIDÆ.

67. CLIVICOLA COWANI (Sharpe).

Cotile cowani, SHARPE, Jour. Linn. Soc., Zool., XVI, 1882, p. 322. (Ankafana, Betsileo, southeast, Madagascar.)

Two specimens. Female adult, Andrangolsaka, Imerina, March 28. Female immature, Mahatsara, River Mangoro, April 1.

Family CAMPEPHAGIDÆ.

68. GRAUCALUS CINEREUS (Müller).

Muscicapa cinerea, MÜLLER, Syst. Nat., Suppl., 1776, p. 171. (Madagascar.)
Graucalus cinereus, SHARPE, Cat. Birds Brit. Mus., IV, 1879, p. 28.

Three specimens. Female adult, 50 miles northwest of Mahanoro, April 13. Male adult, same locality, April 14. Female? adult, Mahanoro, May 3.

Family DICRURIDÆ.

69. DICRURUS FORFICATUS (Linnæus).

[*Lanius*] *forficatus*, LINNÆUS, Syst. Nat., 12th ed., I, 1766, p. 134. (Madagascar.)
Di[*crurus*] *forficatus*, STEPHENS, Gen. Zool., XIII, Pt. 2, 1825, p. 138.

Three specimens. Female adult, 50 miles northwest of Mahanoro, April 13. Male immature, 40 miles northwest of Mahanoro, April 17. Male adult, Ambodiasy, valley of Faraony, east coast, June 20.

Family LANIIDÆ.

70. XENOPIROSTRIS POLLENI (Schlegel and Pollen).

Vanga polleni, SCHLEGEL and POLLEN, Faun. Madag., 1868, p. 174. (Madagascar.)
Xenopirostris polleni, HARTLAUB, Vög. Madag., 1877, p. 193.

Two specimens. Male adult, Mahanoro, May 1. Male adult, River Sakalés, May 16. "Betsimisarka name *Angávosika*."

71. VANGA CURVIROSTRIS (Linnæus).

[*Lanius*] *curvirostris*, LINNÆUS, Syst. Nat., 12th ed., I, 1766, p. 135. (Madagascar.)
[*Vanga curvirostris*], CUVIER, Règne Anim., I, 1817, p. 339.

Two specimens. Female adult, Ambodiasy, valley of Faraony, June 17. Male adult, Marohita, near Mananjara, east coast, June 27.

72. ARTAMIA LEUCOCEPHALA (Gmelin).

[*Lanius*] *leucocephalos*, GMELIN, Syst. Nat., I, Pt. 1, 1788, p. 307. (Madagascar.)
[*Artamia leucocephala*], LAFRESNAYE, Dict. Univ., II, 1843, p. 166.

One specimen. Male immature, River Mangoro, April 2. The cross bars are present only on the lower chest, and here very faint.

73. ABBOTTORNIS[1] CHA-BERT (Müller).

Lanius cha-bert, MÜLLER, Syst. Nat., Suppl., 1776, p. 72. (Madagascar.)

Three specimens. Female adult, Mahanoro, May 2, 9; two specimens. Male adult, Mananjara, east coast, May 26.

[1] *Abbottornis*, new generic name for *Leptopterus*, BONAPARTE, 1850 (nec *Leptoptera*, BOISDUVAL, 1842).

74. CALICALICUS MADAGASCARIENSIS (Linnæus).

[*Lanius*] *madagascariensis*, LINNÆUS, Syst. Nat., 12th ed., I, 1766, p. 137. (Madagascar.)
Calicalicus madagascariensis, BONAPARTE, Comp. Rend., XXXVIII, 1854, p. 535.

Three specimens. Female adult, Imahatsara, River Mangoro, April 3. Male adult, Mananjara, east coast, May 25; two specimens.

Family CORVIDÆ.

75. CORVUS SCAPULATUS, Daudin.

Corvus scapulatus, DAUDIN, Traité, II, 1800, p. 232. [Africa.]

One specimen. Male adult, River Namorona, east coast, June 25.

Family STURNIDÆ.

76. HARTLAUBIUS AURATUS (Müller).

Turdus auratus, MÜLLER, Syst. Nat., Suppl., 1776, p. 140. (Madagascar.)

Two specimens. Female adult, Mahanoro, May 3. Female adult, Mananjara, east coast, May 28.

Family MELIPHAGIDÆ.

77. ZOSTEROPS MADERASPATANA (Linnæus).

[*Motacilla*] *maderaspatana*, LINNÆUS, Syst. Nat., 12th ed., I, 1766, p. 334. (Madagascar.)

Two specimens. Male adult, Andrangolsaka, Imerina, March 28. Female adult, Imahatsara, River Mangoro, April 3.

Family NECTARINIIDÆ.

78. NEODREPANIS CORUSCANS, Sharpe.

Neodrepanis coruscans, SHARPE, Proc. Zool. Soc. Lond., 1875, p. 76. (Madagascar.)

One specimen. Female adult, 60 miles northwest of Mahanoro, April 12.

79. CINNYRIS NOTATUS (Müller).

Certhia notatus, MÜLLER, Syst. Nat., Suppl., 1776, p. 99. (Madagascar.)
Cinnyris notatus, SHELLEY, Monogr. Nect., 1876, p. 195.

Five specimens. Male immature, Ambodivongo, Ankay Valley, March 29. Male adult, Mahanoro, May 1, 3; three specimens. Female adult, Mahanoro, May 1.

80. CINNYRIS SOVI-MANGA (Gmelin).

[*Certhia*] *sovi-manga*, GMELIN, Syst. Nat., I, Pt. 1, 1788, p. 471. (Madagascar.)
[*Cinnyris*] *sovi-manga*, BONAPARTE, Consp. Av., I, 1850, p. 407.

Seven specimens. Male immature, Imahatsara, River Mangoro, April 3. Male immature, 60 miles northwest of Mahanoro, April 12.

Female adult, Mahanoro, May 1. Male adult, Mahanoro, May 9. Male adult, River Sakalés, east coast, May 11. Male adult, same locality, May 16; two specimens.

Family PLOCEIDÆ.

81. SPERMESTES NANA (Pucheran).

Pyrrhula nana, PUCHERAN, Rev. Zool., 1845, p. 52.
[*Spermestes*] *nana*, BONAPARTE, Consp. Av., I, 1850, p. 454.

Three specimens. Male adult, Andrangolsaka, Imerina, March 26; two specimens. Female adult, same locality and date.

82. NELICURVIUS NELICOURVI (Scopoli).

Parrus (*nelicourvi*), SCOPOLI, Del. Faun. et Flor. Insubr., II, 1786, p. 96. (Madagascar.)
Nelicurvius nelicouri, BARTLETT, Proc. Zool. Soc. Lond., 1879, p. 771.

Three specimens. Male immature, Ambodiasy, valley of Faraony, June 15. Female adult, same locality and date. Female immature, same locality, June 17.

83. FOUDIA MADAGASCARIENSIS (Linnæus).

[*Loxia*] *madagascariensis*, LINNÆUS, Syst. Nat., 12th ed., I, 1766, p. 300. (Madagascar.)
[*Foudia*] *madagascariensis*, BONAPARTE, Consp. Av., I, 1850, p. 445.

Four specimens. Male adult, Andrangolsaka, Imerina, March 26, 27; 4,500 feet; two specimens. Male immature, same locality and dates; two specimens.

ON THE INSECTS COLLECTED BY DOCTOR ABBOTT ON THE SEYCHELLES, ALDABRA, GLORIOSO, AND PROVIDENCE ISLANDS, WITH DESCRIPTIONS OF NINE NEW SPECIES OF COLEOPTERA.

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THE INSECTS collected by Doctor W. L. Abbott on the Seychelles in 1890 and on his excursions to Aldabra, Glorioso, and Providence islands in 1893, while not numerous in species are of unusual interest on account of their geographical distribution. The writer has paid particular attention to the study of the Coleoptera, but it seems advisable to mention also the insects of the other orders, although all of these have not been specifically identified. Doctor W. J. Holland has already reported upon the Lepidoptera.[1]

INSECTS FROM SEYCHELLES ISLANDS.

LEPIDOPTERA.

Eight species of butterflies and nine species of moths are reported upon by Doctor Holland as collected by Doctor Abbott on these islands. Of the moths, one is described as new and the other eight have a wide distribution. Of the butterflies, three are peculiar to the islands (one described by Doctor Holland), two occur also on Madagascar, two on the African continent, and one species in the East Indies.

Mr. Charles Alluaud collected, in 1893, 67 species of Lepidoptera, on which L'Abbé de Joannis reports[2] that 80 per cent. is also found on Madagascar, 60 to 65 per cent. in southeastern Africa, 45 per cent. in India, and 20 to 25 per cent. in the Mediterranean region. This paper has unfortunately been overlooked by Doctor Holland, who has redescribed *Atella philiberti* of Joannis as *A. seychellarum*.

ORTHOPTERA.

Doctor Abbott collected three imagoes and two nymphs of a splendid leaf insect, *Phyllium gelonus*, Gray. Two other species of the genus are recorded from the Seychelles. The distribution of this family of insects

[1] Proc. U. S. Nat. Mus., XVIII, No. 1064, pp. 265–273.
[2] Bull. Soc. Ent. France, 1893, p. 51.

on the Seychelles and Mascarene islands, India, and Malay Archipelago, as far as New Caledonia, Fiji Islands, and the New Hebrides, has furnished one of the strongest arguments for the former existence of the hypothetical continent Lemuria. The males can hardly fly, and the females not at all.

HYMENOPTERA.

Polistes sp., *Eumenes* sp., *Apis mellifica*, *Xylocopa* sp., *Megachile* sp., *Larra* sp., *Sphegidæ*, two species, and *Pimpla* sp., all from Mahé Island.

HOMOPTERA.

A species of *Cicada*, very much resembling *Tettigia orni*, from Europe, but smaller.

COLEOPTERA.

Only three or four species of Coleoptera were known from the Seychelles as late as the year 1891, but in that year Doctor Fairmaire recorded fifteen species, collected by Père Philibert.

From March to May, 1892, Mr. Charles Alluaud made a thorough search for the insects generally, and Coleoptera in particular. Of this latter order he collected about one hundred and fifty species, and remarks that these islands, considering their place under the equator and being abundantly covered with woods, are the poorest in insects of any in the world. He also considers the relation to the Indo-Malayan fauna and favors the probable existence of the continent Lemuria. Doctor Abbott collected the following seven species, one of which seems to have escaped description:

1. AGRYPNUS INSULARIS, Fairmaire.

Agrypnus insularis, FAIRMAIRE, Bull. Soc. Ent. France, LX, 1891, p. 70.

This species which was collected in six examples on the Mahé Island by Doctor Abbott is peculiar to the Seychelles, and, although the genus is well represented in Africa, its nearest allied species known is from the Philippine Islands. Another species of the genus, *A. fuscipes*, Fabricius, also occurs here and extends to continental Africa and the East Indies.

2. PARASTASIA COQUERELI, Fairmaire.

Parastasia coquereli, FAIRMAIRE, Ann. Soc. Ent. France, 4 ser., IX, 1869, p. 789.

The most interesting species of the lot, belonging to a genus from the Indo-Malayan region. Doctor Abbott collected one example on the Mahé Island, where Doctor Fairmaire's type also was obtained.

3. ADORETUS UMBROSUS, Fabricius.

Melolontha umbrosa, FABRICIUS, Ent. Syst., I, Pt. 2, p. 169.

This species is recorded from Bourbon, Ile de France, Senegal, Java, Sumatra, and Philippine Islands. One example was collected on Mahé Island and another one on Glorioso Island.

4. ORYCTES MONOCEROS, Olivier.

Scarabæus monoceros, OLIVIER, Ent., I, Pt. 3, p. 37.

Of this large Dynastid beetle Doctor Abbott brought three examples from Mahé Island and four from Doros Island of the Amirantes group. It is a species of wide range on the African continent, and was originally described from Senegal. The genus occurs in the Old World, and the largest species are from Africa and Madagascar.

5. XYSTROCERA GLOBOSA, Olivier.

Cerambix globosus, OLIVIER, Ent., IV, p. 27.
Callidium rittatum, FABRICIUS, Ent. Syst. I, Pt. 2, p. 323.

This is a widely distributed longicorn beetle, recorded from Senegal, Ile de France, Madagascar, Comore Islands, and the East Indies. Doctor Abbott collected one example on Mahé Island.

6. COPTOPS BIDENS, Fabricius.

Lamia bidens, FABRICIUS, Syst. Ent., p. 177.
Lamia ædificator, FABRICIUS, Ent. Syst., I, Pt. 2, p. 275.
Lamia rillica, OLIVIER, Encycl. Meth., VII, p. 468.

Another longicorn of wide distribution. It occurs in East Africa, on Madagascar, all the islands of the vicinity, and in the East Indies. Doctor Abbott collected three examples on Flat Island.

7. CRATOPUS GRISEOVESTITUS, new species.

Robust, uniformly piceous, densely covered with small grayish-white scales. Antennæ pubescent, rather stout; scape reaching the hind margin of the eye; first and second joint of the funicle subequal, one-half longer than broad; third to seventh beadlike, slightly increasing in width; club tomentose, as long as the last five joints together, terminal joint the longest, acuminate at apex. Eyes rather large, longitudinally oval, feebly convex. Rostrum quadrangular, flat above, with distinct lateral carinæ, starting from the frontal margin of the eyes at their middle and diverging toward apex. Front with a short impressed fovea between the eyes. Thorax broader than long, strongly rounded at the sides, broadly constricted at apex; disk coarsely granulate. Scutellum semioval, with dense white scales. Elytra one-half broader than thorax, squarely truncate at base, slightly wider behind the middle, conjointly shortly acuminate at apex; humeri oblique, obtuse; disk rather strongly punctate in regular striæ; striæ, except the marginal, not impressed; intervals flat, less coarsely, sparsely punctate, slightly granulate at base; the scaly pubescence forming numerous white dots. Ventral surface sparsely punctate, sides of thorax scaly, median part and abdomen pubescent. Legs short, stout, pubescent, not scaly. Femora feebly inerassate, the anterior pair with acute tooth. Anterior tibiæ nearly straight, feebly dentate within. Tarsi with first joint slightly longer than second, third moderately dilated. Claws connate

at base, divergent at apex. Length, 10 to 11 mm. Nine examples from Mahé Island.

Type.—No. 576, U.S.N.M.

Cratopus is a genus of Cyphides, allied to the West Indian genus *Lachnopus* by the prolonged anterior legs and robust femora, but differing by the claws being connate at base and thorax truncate, not bisinuate behind. Numerous species are described from Bourbon and Ile de France, and a few from India and South Africa.

INSECTS FROM ALDABRA ISLAND.

The only insects from Aldabra Island that I can find recorded are a few Coleoptera by Doctor Fairmaire.[1] He enumerates five species: *Cicindela trilunaris*, Klug, var.; *Opatrinus insularis*, Mulsant; *Gonocephalus micans*, Germar; *Heteroderes complanatus*, Klug and *Cassida decolorata*, Boheman, with var. *lutea*, all of which were previously known from Madagascar. The only new species he describes is *Cratopus viridisparsus*. As will be seen by the list below, the coleopterous fauna of the island is raised to twelve species through the collection of Doctor Abbott, who has published some very interesting notes on this and Glorioso Island.[2]

After I furnished the footnote[3] for this paper, additional material was received by the National Museum, as is shown by comparison with the report on the Lepidoptera[4] by Doctor Holland, who records thirteen species, two of which he described as new, from this island.[5]

The additional material includes two species of Hemiptera—*Dysdercus* sp., and *Harpactor* sp., and raises the number of Coleoptera to seven, as follows:

1. ERETES STICTICUS, Linnæus.

This water beetle has about the same geographical distribution as the butterfly, *Diadema misippus*, is likewise rare in the warmer parts of America, including Galapagos Islands, and abundant in the Old World through Africa and southern Asia to Japan. Doctor Sharp remarks, in his monograph of the family Dytiscidæ, that this species occurs in a larger number of islands than any other Dytiscid. It varies considerably in size and markings, but is remarkably constant in structural characters throughout its range. Twelve species of the genus have been described, of which Doctor Sharp has united ten under the above name, but the two Australian forms he considers as distinct under the name *E. australis*, Erichson. The only example collected by Doctor Abbott on the Aldabra is a female of small size, dark color, and distinct maculation on the thorax.

[1] Bull. Soc. Ent. France, LXV, 1896, p. 222.

[2] Proc. U. S. Nat. Mus., XVI, pp. 759–764.

[3] Loc. cit., p. 762.

[4] Proc. U. S. Nat. Mus., XVIII, No. 1064, pp. 265–273.

[5] The types of Doctor Holland's species, *Teracolus aldabrensis*, are from Mahé Island, but there are seven cotypes from Aldabra.

2. CYBISTER TRIPUNCTATUS, Olivier.

This species belongs to the most highly developed group of carnivorous water beetles, where the limit of the species is rather opinionative. As Doctor Sharp, in his monograph mentioned above, has restricted it, its range is very wide, from Senegal to the Cape, and along the east coast of Africa to South Europe, and through southern Asia to China and Japan in the north, and over the whole of Australasia to Australia. *C. cinctus*, Sharp, its representative on Madagascar, he doubtfully considers a distinct species. He reviews carefully the races and generalizes them into four principal ones: (1) An Asiatic form also occurring in Australia, (2) an Archipelagic form from Malay Archipelago, occurring also on Bourbon and Ile de France, (3) a sporadic form on the Philippine islands and certain parts of Malay Archipelago, and (4) an African form. Examples of the last were collected by the Chanler-Hœhnel expedition on the Tana River. They are large, oval, with broad yellow margin, exactly similar to others before me from the Cape and Loanda.

The six examples collected by Doctor Abbott on Aldabra are all small, ovate, and with narrow margin, exactly like a large series from Japan before me. Thus, it is remarkable to see that the Asiatic variety occurs here, while the large broad Archipelagic form is recorded from Bourbon and Ile de France.

3. PHÆOCHROUS INSULARIS, new species.

Ovate, convex, above piceous black, margin ciliate with long rufous hairs; ventral surface and legs rufocastaneous, rufohirsute. Head finely punctulate, abruptly and strongly constricted a little before the eyes. Clypeus continuous with the front, sides distinctly margined, slightly convergent; apex subtruncate. Labrum strongly transverse, coarsely punctate, broadly emarginate. Thorax at base twice broader than long, surrounded with an entire margin; sides not deplanate, arcuately narrowed to the apex; anterior angles acute, posterior angles rectangular, with rounded apex; base broadly sinuate on each side; disk sparsely and finely punctulate, nearly smooth at the middle. Scutellum oblong, sparsely punctate. Elytra at base not broader than thorax, arcuately widened and broadest behind the middle; sides not explanate; apices separately rounded; disk moderately finely, diffusedly punctate; sutural stria impressed but the others indistinct. Anterior tibiæ tridentate, serrulate even between the teeth; upper tooth small, the two apical teeth long, recurved. Length, 8 to 9 mm.

Male: Tarsi incrassate, claws broadly appendiculate at base.

Type.—No. 581, U.S.N.M.

Doctor Abbott collected one male and three females of this Scarabæid on Aldabra Island. It resembles in form *P. beccarii*, Harold, from tropical East Africa, but is much smaller. The margins are not explanate and the sculpture is different. A moderate number of

species of this genus are described from Africa, Madagascar, East Indies to Philippine Islands and Australia. They probably live, like our species of Trox, on decaying animal substances.

4. OXYTHYREA ALDABRENSIS, new species.

Slender, shining, glabrous above, very sparsely setose beneath, entirely black, with antennæ and palpi ferruginous. Clypeus strongly margined, slightly emarginate, finely punctate. Front and vertex coarsely punctate, the latter with three smooth spaces, arranged transversely. Thorax very narrow; sides feebly rounded, almost subangulate at middle, strongly convergent toward apex; posterior angles very obtuse, nearly rounded; base broadly rounded, with emarginations obsolete; disk coarsely punctate, with six impressed white patches: two on each side-margin, very large, nearly reaching the angles, separated just in front of middle, making the posterior ones twice as large as the others; two longitudinally lunulate spots in front of scutellum, more widely apart than in allied continental species. In one specimen there is another pair of smaller spots in front of these. Scutellum glabrous, sharply acuminate. Elytra outlined as in *O. marginalis*, Swarz, but the striæ are not impressed, except the two nearest the suture behind the middle. The intervals are nearly smooth, not depressed, and the white patches are less numerous and much larger. There are three pairs of small sutural spots, two larger spots inside and behind the humeral callus, sometimes connected, and the inner one sometimes connected with the median sutural, forming an oblique band. The transverse marginal spot behind the middle is very large, extending inward to the third stria and has a posterior elongate marginal spot as an appendix; apical spot large, transverse. Pygidium nearly semicircular, with a few annular scratches on the middle, each side covered with a triangular niveous patch. Ventral surface sparsely punctate with a large square niveous patch on the sides of metasternum, an oblong one on its episternon, and another one on the side margin of the coxæ. A row of transverse spots each side on the abdomen, not marginal, as in many allied species, but at the middle of each segment, sometimes absent. No trace of spine on fifth ventral segment. Proportion of legs, tibial armature, and claws as in *marginalis*, Swarz. Length, 9 mm.; width, 4, 5 mm. Four examples.

Type.—No. 577, U.S.N.M.

This nice little species is allied to *O. marginalis*, Swarz, from South Africa, but is much smaller, more slender, and altogether differently maculate. The genus is represented by numerous forms over the whole of Africa, Arabia, Syria, and Europe, extending to east Siberia.

5. MICROTHYREA ALDABRENSIS, new species.

Less robust, very shining, glabrous above, entirely black, with large impressed niveous patches with a rosy tint. Clypeus as in *M. amabilis*, Schaum, but deeply emarginate at apex. Front rather sparsely punc-

tate; vertex smooth at middle. Thorax short, with the sides only slightly converging from base to middle, then strongly arcuate to apex; posterior angles obtuse; base broadly arcuate, scarcely truncate at middle, and slightly sinuate each side; disk sparsely and minutely punctate with six large rounded patches: two pairs marginal, the posterior one oblong, larger, and two smaller rounded basal spots in the normal position; one specimen has an additional pair on the disk, but very small. Scutellum smooth, acute. Elytra outlined as in *M. amabilis*, but the striæ are not impressed, the punctures are nearly obsolete in the scutellar region, and the white patches are smaller. There are on each side three sutural spots, rather small, a small spot above and another beneath the humeral callus; three marginal spots, the anterior two large, a large apical and some irregular smaller spots. The pygidium is transversely strigose at middle and has a large round niveous patch each side. Metasternum smooth and polished at middle, with a large quadrangular niveous patch, covering the sides. Hind coxæ strigose, with a round spot at side margin. Ventral segments strigose at the sides, with a transverse row of punctures on the middle of each, fifth with an obtuse tooth at the lateral posterior margin, sixth subtruncate. Legs as in *amabilis*, the anterior femora densely fimbriate. Length, 11.5 mm.; width, 7 mm. Three female examples.

Type.—No. 578, U.S.N.M.

This species is very distinct from *amabilis*, Swarz, and allied forms of the African continent by the characters given above. The genus *Microthyreus* has been erected for certain African species, formerly included in *Oxythyrea*, that show strongly developed sexual characters in the male. That the above-described female belongs to the genus is inferred from the fact that the fifth abdominal segment has marginal spines.

6. LEPTOCERA ALDABRENSIS, new species.

Elongate, black, with impressed longitudinal bands on thorax and elytra, covered with a very dense, white, silky pubescence. Antennæ piceous, as long as the body, very sparsely pubescent, slender; first joint stout, clavate, strongly curvate; third joint nearly as long as fourth and fifth together. Head broader than thorax, densely pubescent; antennal tubercles and a spot on vertex glabrous; palpi small, last joint slender, slightly and obliquely truncate at apex. Thorax cylindrical, feebly constricted at each end, deeply punctate, opaque, with four longitudinal vittæ. Elytra dark green, at base broader than thorax, slightly narrowed behind; apices squarely truncate; disk somewhat depressed, coarsely punctate in regular striæ, interrupted by the impressed white vittæ; sutural vitta entire, a discal vitta from base to middle, somewhat directed toward the suture; a second discal vitta on the posterior half, connected at apex with the sutural, extending somewhat beyond the middle in front; subhumeral vitta short. Ventral surface densely pubescent, side margin of metasternum and middle of

abdomen glabrous and smooth. Legs red, femora strongly clavate, finely pubescent. Tarsi infuscate, broad, short; first joint of hind tarsi somewhat longer than the second. Length, 9.5 mm. One example from Aldabra Island.

Type.—No. 579, U.S.N.M.

This species is nearly allied to *Glaucites* (*Leptocera*) *lineaticollis*, Fairmaire, from Madagascar, but is distinct by the piceous antennæ, stronger punctuation of thorax and a different arrangement of the pubescent lines on the elytra. Two other species of the genus are described from Madagascar, one of which also occurs on Ile de France.

7. CRATOPUS VIRIDISPARSUS, Fairmaire.

Cratopus viridisparsus, FAIRMAIRE, Bull. Soc. Ent. France, LXV, 1896 p. 222.

This is the only beetle recorded from Aldabra by Doctor Fairmaire that was also collected there by Doctor Abbott. Two examples were obtained. I have had a manuscript description of it for the last two years and barely escaped making a synonym before going to press.

INSECTS FROM GLORIOSO ISLAND.

The insects collected by Doctor Abbott on this little island are as follows:

LEPIDOPTERA.

Two species of butterflies and three of moths, all of wide distribution. (Reported upon by Doctor Holland.)

NEUROPTERA.

Two species of *Myrmeleon* and one of *Palpares*.

DIPTERA.

Three species: *Asilus*, *Tabanus*, and *Myodina*.

HYMENOPTERA.

Four species: *Eumenes*, *Megachile*, and *Sphegidæ*, two species. Three of these were also collected on Mahé Island.

HEMIPTERA.

Nezara viridula, Linnæus, a cosmopolitan species, and *Leptoglossus membranarius*, Fabricius. The latter species is common on Madagascar.

HOMOPTERA.

A large *Cicada*, closely allied to the South African *Platypleura limbata*, Fabricius, but the fore wings are more densely maculate.

COLEOPTERA.

Five species, of which three are here described as new. One is previously described from the Seychelles, and the remaining one is of wide distribution in Africa and Malayan Archipelago.

1. LUCIOLA ABBOTTI, new species.

Elongate, parallel, feebly shining, finely pubescent, bright ferruginous; head with antennæ and palpi, elytra, tibiæ and tarsi black. Antennæ short, not reaching to middle of body, nearly filiform, densely setose; first joint ferruginous beneath, as long as the fourth; third slightly longer than fourth; fourth to tenth slightly decreasing in length. Thorax nearly twice broader than long, somewhat narrowed in front; side margin feebly rounded, reflexed; posterior angles rounded; apex margined, feebly bisinuate; base more distinctly bisinuate, strongly margined, deeply impressed each side of middle; disk finely and densely punctate, deplanate at the sides, deeply canaliculate at the middle. Scutellum brownish red, obtuse at apex. Elytra slightly broader than thorax, separately rounded at apex, very densely and finely rugosopunctate; suture elevated and three obsolete carinæ each side.

Male: Abdomen with fourth and fifth segments pale, the fourth emarginate at middle, the fifth strongly constricted and produced in a large lobe; last dorsal segment triangularly emarginate. Length, 10 mm.

Type.—No. 580, U.S.N.M.

One single example, a male, was taken on Glorioso Island. It agrees in color and many other characters with *L. transversicollis*, Fairmaire, described from Sainte-Marie-de-Madagascar, Mahé, and Mayotte, but Doctor Fairmaire's species has the third ventral segment pale and the posterior angles of thorax nearly rectangular. The genus is of wide distribution in the Old and New World.

2. PERISSOSOMA ÆNESCENS, Waterhouse.

Perissosoma æneseens, WATERHOUSE, Ann. Nat. Hist., 4 ser., XV, 1875, p. 415.

Four examples of this very peculiar Melolonthid, of doubtful systematic position, were collected by Doctor Abbott on Glorioso Island. They agree exactly with Doctor Waterhouse's description, the type of which was from the Seychelles.

3. ADORETUS UMBROSUS, Fabricius.

Melolontha umbrosa, FABRICIUS, Ent. Syst., I, Pt. 2, p. 169.

For remarks on this species, see notes under *Adoretus umbrosus*, Fabricius, from the Seychelles Islands, page 696.

4. OXYTHYREA ABBOTTI, new species.

Robust, shining, glabrous above, very sparsely pubescent beneath, dark castaneous, including antennæ and legs; occiput and disk of thorax black. Clypeus shorter than in *O. marginalis*, Swarz, scarcely narrowed at apex, feebly rounded on the sides; distinctly but slightly emarginate at apex, densely and finely punctate; margins slightly depressed. Front immaculate, less densely but more strongly punc-

tate, with irregular, smooth median line. Thorax broadest at base, very strongly narrowed toward apex; sides colored exactly as the disk, broadly rounded before middle, distinctly sinuate before the hind angles, which are rectangular, with obtuse apex; base broadly rounded, with very slight indication of emargination on each side and in front of scutellum; disk sparsely but rather deeply punctate over the whole surface, with eight impressed niveous spots—the two largest are marginal, one at the middle and one in front, connected at the margin; the basal and discal pair in the normal position, as in *O. marginalis;* one of the specimens has still another pair of spots, though very small, on the disk near the apex, as in some specimens of *O. marginalis.* Scutellum smooth, large, sharply acuminate. Elytra outlined as in *marginalis,* but the striæ are less impressed, all coarsely punctate; intervals nearly smooth, varying in width, but none of them depressed, obsoletely strigose at apex; the niveous spots are six or seven each side—an elongate spot near apex of scutellum, a small round one behind the humeral callus, a large transverse spot just behind the middle of margin; in one specimen a small oblique one on the disk inside; two spots just before apical callus, the one marginal, the other one near suture, the apical spot touching the margin behind. Pygidium semicircular, with annular punctures, transversely strigose at base, and on each side a large niveous spot. Ventral surface punctate, with a large transverse niveous patch covering the sides of metasternum and its episternum. Abdomen with small round spots at the sides; fifth segment without any trace of spines. Proportion of the legs and anterior tibiæ as in *marginalis.* Anterior femora with longer, grayish-white ciliation. Length, 11 mm.; width, 6.5 mm. Two examples.

Type.—No. 582, U.S.N.M.

This species has the form of *O. marginalis,* Swarz, from South Africa, but is larger, stouter, and very different in the arrangement of the niveous patches.

5. CRATOPUS ABBOTTI, new species.

Elongate, broader behind, convex, black, shining, sparsely covered with small rounded metallic green scales above; antennæ and legs rufous. Antennæ slender, sparsely pubescent; scape very long, reaching the margin of thorax, slightly clavate and curvate; first joint of funicle a little longer than the second, both elongate; third to seventh short, equal in length, slightly increasing in width; club fusiform, densely tomentose, as long as the last four joints of the funicle together, distinctly annulate, the three joints equally long. Rostrum shorter than the head, cylindrical, convex above, sparsely punctate, each puncture with a scale. Eyes large, longitudinally oval, feebly prominent. Head slightly constricted behind the eyes, sparsely punctate and scaly, scales denser and forming a longitudinal vitta beneath the eyes. Thorax slightly transverse, truncate before and behind, strongly narrowed and constricted at apex, feebly rounded on the sides behind, coarsely, reticu-

lately punctate, the punctures densely scaly at bottom; scales more dense on the inflexed sides and spreading upon the anterior coxæ. Scutellum small, glabrous, smooth. Elytra at base nearly twice broader than thorax, broadest behind the middle, acutely produced at apex; humeri obliquely truncate; side margin serrate toward apex; disk coarsely striatopunctate; punctures transverse, densely squamose at the bottom; intervals narrow, smooth; the two or three marginal striæ deeply impressed, rugose at base. Side pieces of meso and meta thorax and sides of the two first abdominal segments densely squamose; median line of ventral surface nearly smooth, sparsely pubescent. Legs not scaly, sparsely pubescent, the median pair short, the posterior pair longer and the anterior longest; all femora incrassate, but the anterior most strongly, with a small acute tooth beyond the middle; anterior tibiæ slightly curvate, acutely denticulate on the inner side. Tarsi hairy above, without any trace of scales; first joint slightly longer than second; third very wide; claws large, connate at base, divergent at apex. Length, 10 to 12 mm. Three examples from Glorioso Island.

Type.—No. 583, U.S.N.M.

This species comes very near *C. parcesquamosus*, Fairmaire, from the Seychelles, but differs in the sculpture and particularly in the tarsi, that are cœruleo-squamose above in Doctor Fairmaire's species.

INSECTS FROM PROVIDENCE ISLAND.

This island, located about midway between the north end of Madagascar and the Seychelles, is apparently very meager in insect life. Doctor Abbott brought home only three species, one butterfly and one moth—both of which also occur on the African continent and the Seychelles—and the single beetle described below, which is nearest allied to the *Microthyrea aldabrensis* from Aldabra Island.

MICROTHYREA PROVIDENCIÆ, new species.

Moderately robust, shining, glabrous above, with impressed niveous spots, sparsely hirsute beneath. Clypeus formed as in *M. amabilis*, Schaum, but more narrowed and more deeply emarginate at apex. Sides of thorax sinuate behind the middle, arcuately narrowed in front; posterior angles subrectangular; base broadly rounded with obsolete emarginations; disk finely and sparsely punctate, more densely at apex, with six small, round niveous spots; one pair at the front angles, a larger pair marginal behind the middle and one pair in front of scutellum in the normal position. Scutellum large, acuminate, with a few punctures. Elytra outlined and sculptured exactly as in *M. amabilis*, but the niveous spots are much smaller; on each side are three sutural spots, one above and another one behind the humeral umbone, two larger and one smaller (posterior) marginal spots, and a transverse apical spot. An additional spot occurs on the disk inside the anterior

marginal. Pygidium elevated at middle and concentrically strigose, at apex transversely aciculate with subtruncate margin; a smaller niveous spot each side. Ventral surface hairy; metasternum coarsely but sparsely punctate, broadly niveous at the sides; hind coxæ partly strigose; abdominal segments coarsely punctate in transverse rows, strigose at side margin; fifth with an obtuse spine at the lateral posterior margin, sixth covered at the sides, seventh truncate. Legs hairy, aciculate; anterior femora densely fimbriate; posterior femora and tibiæ strongly incrassate (male), the former curvate; exterior claw of front tarsi very long, incrassate at middle, and contorted. Length, 11 mm.; width, 7 mm. Two males from Providence Island.

Type.—No. 584, U.S.N.M.

CAMBRIAN BRACHIOPODA: GENERA IPHIDEA AND YORKIA, WITH DESCRIPTIONS OF NEW SPECIES OF EACH, AND OF THE GENUS ACROTHELE.

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THIS IS THE first of a proposed series of preliminary papers on the Cambrian Brachiopoda, to be published in advance of a memoir on the subject. Owing to administrative duties, only a small part of each year can be devoted by me to palæontologic studies. In the present paper the genera *Iphidea* and *Yorkia* are discussed. Succeeding papers will treat of other well-known genera.

IPHIDEA, Billings.

Iphidea, BILLINGS, 1872, Can. Nat., new ser., VI, p. 477, fig. 13.
Micromitra, MEEK, 1873, Sixth Ann. Rept. U. S. Geol. Surv. Terr., for 1872, p. 479.
Iphidea, BILLINGS, 1874. Pal. Foss., II, Pt. 1, p. 76.
Iphidea, LINNARSSON, 1876, Bihang Till K. Svenska Vet. Akad., Handlingar, No. 12, p. 26. Brachiopoda of the Paradoxides Beds of Sweden.
Iphidea, WALCOTT, 1886, Bull. U. S. Geol. Surv., No. 30, p. 100.
Paterina, BEECHER, 1891, Am. Jour. Sci., XLI, p. 345.
Iphidea, HALL and CLARKE, 1892, Pal. N. Y., VIII, Pt. 1, p. 97.
Iphidea, HALL and CLARKE, 1892, Eleventh Ann. Rept. State Geol. N. Y., p. 249.
Paterina, HALL and CLARKE, 1892, Eleventh Ann. Rept. State Geol. N. Y., p. 247.

The description of the genus *Iphidea* and that of the type species were combined. At the time of my study of *Kutorgina* and *Iphidea* I did not agree with Mr. Billings in his reference of *Obolus labradoricus* to *Kutorgina*,[1] overlooking the fact that he had referred *O. labradoricus* to *Iphidea*.[2] Since that time I have collected more material representing this group of shells, and from its study have come to the conclusion that Mr. Billings was correct in referring *O. labradoricus* to *Iphidea*. The ventral valve of *O. labradoricus* has a narrow false area of the same type as *Iphidea bella*, and the characteristic pseudodeltidium is clearly shown in a section, and it is known to occur in *I. sculptilis*, Meek, *I. ornatella*, Linnarsson, and *I. pannula*, White. The extreme development of the false area and pseudodeltidium is found in an undescribed

[1] Bull. U. S. Geol. Surv., No. 30, 1886, p. 100.
[2] Pal. Foss., II, Pt. 1, p. 76.

species of *Iphidea* (*I. superba*) from the Middle Cambrian Tonto sandstone of the Grand Canyon of the Colorado. In this form the ventral valve is broadly conical, and the large pseudodeltidium projects backward at an angle equal to that of the slope from the apex to the front. In *I. bella* the false area slopes more abruptly downward, and in *I. ornatella* it is nearly vertical, the pseudodeltidium being much shorter and projecting but a short distance beyond the area. The slope of the area of *I. ornatella* is essentially the same as that of *I. labradorica* var. *swantonensis*, which is the type of Mr. Beecher's genus *Paterina*. In some specimens of the latter species the beak projects so that the slope of the area carried it forward to a considerable distance under the beak. This is also true of *I. pannula*.

The presence of an apical foramen in *I. bella* and *I. ornatella* would separate the genus from *Paterina*, but, from a careful study of all the evidence attainable, I am led to question the presence of a true apical foramen in either species. Unless there are other characters than those shown by the false area and pseudodeltidium and the angle at which they slope, it will be impracticable to generically separate *I. bella* and *I. labradorica* and the other species mentioned.

In his original description, Mr. Billings says:

> In the specimen above figured there is an aperture in the beak, but in another there is no appearance whatever of a perforation.[1]

Professor Whiteaves writes me, under date of July 23, 1896, that there are no specimens or electrotypes of the types of *I. bella* in the collections of the Geological Survey of Canada, nor of the closely allied species of the same genus from Topsail Head, mentioned by Mr. Billings. Under the circumstances, nothing can be done but to decide from Mr. Billings's description and figure the characters of the genus and species, and refer to the species the form that can best be identified with the description and figure as the specific type of the genus. This appears to be the species from the York limestone of Pennsylvania.

In a fine series of *Iphidea bella* from the Lower Cambrian, south of Emigsville, York County, Pennsylvania, the characteristics of the genus and species are strikingly well shown. In none of the specimens is there in the ventral valve an indication of an apical pedicle opening. The dorsal valve is slightly elevated, and in the half dozen well-preserved specimens no trace has been observed of any false area or pseudodeltidium; but in *I. pannula* the false area is even more clearly defined than in the ventral valve, and the pseudodeltidium is present as a depressed concave covering of more than one-half of the triangular space inside the narrow area on each side. The area on the dorsal valve has also been observed in *I. ornatella* and *I. labradorica*.

Doctor Linnarsson, in describing *I. ornatella*, speaks of the presence of a minute foramen; but, after the study of several finely preserved

[1] Pal. Foss., II, Pt. 1, p. 76.

ventral valves from the Paradoxides beds of Andrarum, Sweden, I am led to believe that what he considered to be an apical foramen is a depression in the apex of the shell in front of the incurved beak, which represents a foramen which was present in one of the embryonic (nepionic) stages, and was subsequently lost. This would involve the crowding out, as it were, of the pedicle posteriorly, the only evidence of its presence in the adult being the narrow, slightly depressed slit at the apex of the valve in some specimens. The pedicle in the adult shell is protruded between the two valves and separated from the embryonic pedicle opening by the growth of a pseudodeltidium.

The examination of the somewhat closely allied form, *I. pannula*, shows the presence in some specimens of the apical depression and its absence in others. In an undescribed species, *I. superba*, still more closely approaching the type *I. bella* in external appearance, there is no trace of an apical slit or foramen. In another species associated with *I. superba* (*I. crenistria*) the apex is rounded, while in a somewhat similar but distinct form (*I. pealei*), from the Gallatin River valley of Montana, the apical slit is as clearly shown as in *I. ornatella*, but not any apical foramen.

Messrs. Hall and Clarke illustrate a specimen of *I. bella* showing an apical foramen, but in the description of the figure the statement is made that the foramen is not altogether distinct in the specimen.[1]

The systematic position of the genus *Iphidea* appears to be in the Neotremata of Beecher,[2] possibly with characters that nearly place it in the Protremata. If the pedicle was apical in its early stages and inclosed by shell growth, and subsequently was crowded back of a pseudodeltidium, it passed through the Neotrematic stage to the Protrematic. The presence of an obscure listrium in front of the apex of *I. bella*, *I. ornatella*, and some specimens of *I. pealei*, tends to support this view. We also have to consider the area of the dorsal valve as shown in *I. pannula*. In this species there is a rather deep, convex pseudodeltidium in the ventral valve, and a clearly defined, depressed pseudodeltidium on the dorsal valve between the narrow false areas. There is also present a narrow median groove extending from beneath the apex of the valve to the posterior margin of the pseudodeltidium. It is similar in appearance to the pedicle groove of the ventral valve of *Obolus* and *Rhinobolus*. This suggests that it may be the pedicle valve; but the presence of the listrium or embryo pedicle scar on the conical valve is opposed to the interpretation.

It may be urged that *Iphidea* is a true Atrematic genus, the pedicle never having been inclosed and the slit on the ventral valve being only a depression without special significance. This may be so, but the impression it conveys to me is that the slit indicates a pedicle opening near the apex of the ventral valve, at an early stage in its growth,

[1] Pal. N. Y., VIII, Pt. 1, description of pl. IV, fig. 8.

[2] Amer. Jour. Sci., XLI, 1891, pp. 354, 355.

which was subsequently closed, the pedicle then protruding between the valves.

The only interior of any specimen of the genus thus far discovered that shows a trace of muscular scars or vascular markings is the interior of the dorsal valve of *I. pannula*, from near Rome, Georgia. All that is discernible in this is a slight depression in the cast of the interior, about one-third the distance from the beak to the front. A rather strong vascular trunk arches forward on each side of it, nearly to the center of the valve.

Stratigraphic distribution.—The genus ranges from the lowest known Lower Cambrian horizon to the upper portion of the Middle Cambrian. The species thus far referred to the genus are as follows:

Lower Cambrian:
- *Iphidea bella*, Billings.
- *labradorica*, Billings.
- var. *swantonensis*, Walcott.
- *pannula*, White.
- *prospectensis*, Walcott.

Middle Cambrian:
- *Iphidea crenistria*, new species.
- *alabamaensis*, new species.
- *logani*, new species.
- *ornatella*, Linnarsson.
- *pannula*, White.
- *pealei*, new species.
- *pusilla*, Linnarsson.
- *sculptilis*, Meek.
- *stissingensis*, Dwight.
- *superba*, new species.

Ornamentation of the surface.—One of the most noticeable characters is the surface ornamentation. In the type *I. bella* it is formed of simple concentric striæ and lines of growth. This may be called type A, and to it may be referred:

Iphidea bella	Lower Cambrian.
labradorica	Lower Cambrian.
var. *swantonensis*	Lower Cambrian.
prospectensis	Lower Cambrian.
alabamaensis	Middle Cambrian.
logani	Middle Cambrian.
pusilla	Middle Cambrian.
superba	Middle Cambrian.
stissingensis	Middle Cambrian.
crenistria	Middle Cambrian.
pealei	Middle Cambrian.

The second type (B) is represented by *I. sculptilis*, in which the striæ are more crenulated than in *I. crenistria*, but not sufficiently so to give a diamond-shaped interspace.

Type C is a beautiful surface, formed by the union of the crenulated striæ so as to make a fine network of raised, obliquely arranged lines

that divide the surface into minute pits that give the impression of finely woven cloth. *I. ornatella* and *I. pannula* represent this type. Among other genera it may be found in *Trematis;* and the second type of surface, as shown by *I. sculptilis*, is frequently seen on *Lingulella.*

IPHIDEA SUPERBA, new species.

(Plate LIX, figs. 1, 1*a–c.*)

Iphidea cf. ? *ornatella,* 1892, HALL and CLARKE, Pal. N. Y., VIII, Pt. 1, pl. IV, figs. 6, 7.

Ventral (pedicle) valve subconical, with a minute beak incurving over the pseudodeltidium. Cardinal slope slightly flattened, so as to merely indicate an imperfectly defined, rather narrow area. In some specimens the curvature of the shell is practically continuous to the base of the pseudodeltidium. Pseudodeltidium broad, convex, with its lower margin broadly arched, so as to leave a considerable space between it and the line of the general plane of the shell.

Dorsal (brachial) valve slightly convex; most elevated a little in front of the small beak which projects slightly over the broad open (?) delthyrium. No traces of a false area or a pseudodeltidium have been observed.

Surface with rather strong concentric striæ, and a few somewhat obscure lines of growth. On the ventral valve the striæ extend around to and cross the pseudodeltidium. Shell substance corneous.

This is one of the larger species of the genus, being surpassed in size only by *I. labradorica.* It is clearly distinguishable from *I. bella* by its larger size, more depressed ventral valve, and the form of the pseudodeltidium. The dorsal valves of the two species are quite similar. It differs from *I. pealei* in its broad pseudodeltidium, false area, and surface markings.

One specimen has a length of 9 mm. and a little greater width. The area is vertical, the pseudodeltidium being broken away.

Formation and locality.—Middle Cambrian, Tonto Terrane, Chuar and and Nunkoweap valleys, Grand Canyon of the Colorado. (No. 26429, U.S.N.M.)

IPHIDEA LOGANI, new species.

(Plate LIX, figs. 2, 2*a*, 2*b.*)

Ventral (pedicle) valve conical, transverse in outline at base, almost semicircular. Beak minute, incurving over the pseudodeltidium. Cardinal slopes rounded and flattened so as to form a fairly well defined false area that is broken by a very wide triangular space. Pseudodeltidium arched upward, forming a narrow, sloping shelf beneath the beak, the angle of slope from the summit of the shell over the beak and pseudodeltidium being nearly the same as that of the slope from the summit to the front.

Surface marked by very fine concentric striæ and somewhat coarser lines of growth. Under a high power slight traces of radiating striæ

may be observed. The concentric striæ pass around over the false area and cross the pseudodeltidium. Shell substance corneous.

This specimen was received from Professor J. F. Whiteaves as one of the types of *I. bella*. It differs, however, so materially from the description of that species and the figure illustrating it that I found it necessary to give it a distinct specific designation, and I take pleasure in naming it after Sir William E. Logan.

The specimen bears the label "Trois Pistoles, 1868, T. C. Weston." It was collected from a bowlder in the conglomerate at that locality. It is probably of Middle Cambrian age, but this can not be stated with certainty, as there are no associated fossils. Mr. Billings speaks of the occurrence of fragments of trilobites in the bowlder containing this type of *I. bella*. He does not mention the genera or species.

The species approaches most nearly *I. crenistria* in its short pseudodeltidium and finely striated surface. It differs, however, in the character of the surface striæ, the form of the false area, and the pseudodeltidium.

Formation and locality.—Conglomerates at Trois Pistoles on the St. Lawrence, Province of Quebec. The conglomerates of this formation, according to Sir William E. Logan, form nine separate layers, from 2 to 16 feet thick, bedded in gray, calcareous sandstone. The geologic age of the deposit containing the matrix is supposed to be Upper Cambrian or Lower Ordovician. The age of the bowlders can be determined only by the fossils found in each.

IPHIDEA PEALEI, new species.

(Plate LIX, figs. 3, 3*a*-3*c*.)

Ventral (pedicle) valve subconical, beak slightly incurving over the pseudodeltidium. Cardinal slope flattened to form a narrow false area, which is clearly defined from the curvature of the shell by slightly elevated thread-like ridges. Pseudodeltidium comparatively narrow, strongly convex, and arched below. The striæ of growth cross the false area and arch over the delthyrium.

Dorsal (brachial) valve moderately convex, and without any special characteristics to distinguish it from the same valve in *I. bella*, *I. superba*, and *I. labradorica*.

Surface marked by fine concentric striæ and lines of growth that are usually plain, but in some examples are slightly crenulated. In such instances fine radiating lines or striæ are also shown. Shell substance corneous.

In the most perfectly preserved specimens there is a slight slit or depression near the apex of the ventral valve, but there is no trace of a perforation or apical opening.

This species approaches *I. sculptilis* in some examples of the ventral valve. It differs mainly in the narrow pseudodeltidium and the character of the surface markings. It might be considered as a form intermediate between *I. bella* and *I. sculptilis*.

Specific name in honor of Doctor A. C. Peale, who collected the type specimen.

Formation and locality.—Middle Cambrian, Flathead Terrane. North of East Gallatin River, north of Hillsdale, Montana. Also, on the east side of Gallatin River above Gallatin City. (No. 26430, U.S.N.M.)

IPHIDEA CRENISTRIA, new species.

(Plate LIX, figs. 4, 4*a*, 4*b*.)

Pedicle valve subconical, beak nearly apical, curving slightly over to the pseudodeltidium. False area very narrow, separated from the curvature of the shell by being turned somewhat abruptly backward. Pseudodeltidium comparatively broad, but decidedly short as compared with that of *I. bella* or *I. superba*. It is more of the type of *I. labradorica*. It is strongly arched, leaving a broad, high space between it and the plane of the shell.

Dorsal (brachial) valve unknown. Surface of ventral (pedicle) valve marked by very fine, slightly crenulated striæ that are so crowded on the false area that they are nearly lost, and only one or two varices of growth and a few striæ are shown on the pseudodeltidium. No traces of an embryonic foramen are seen, save the slight slit at the apex of the shell.

This species is clearly distinguishable from other described forms of the genus by its highly arched pseudodeltidium and crenulated surface striæ.

Formation and locality.—Middle Cambrian, Tonto Terrane. In thin intercalated limestone layers near head of Nunkoweap Valley, Grand Canyon of the Colorado. (No. 26431, U.S.N.M.)

IPHIDEA ALABAMAENSIS, new species.

(Plate LIX, figs. 5, 5*a*.)

In following the Lower Cambrian rocks southward from Vermont, the first type of *Iphidea* met with is *I. stissingensis*, which occurs in the Middle Cambrian of Dutchess County, New York. This is fairly well distinguished by its surface characters from *I. labradorica* and its variety *swantonensis*, but at the next locality to the south, in eastern Tennessee, four miles north of Rogersville, in the Rogersville shale of the Middle Cambrian, was found a form that is practically identical with the northern species or its variety, as far as it is possible to compare specimens preserved in limestone with those preserved in shale. The same form also occurs in the Middle Cambrian shales of the Cowan Creek section, Cherokee County, Alabama. There is, however, a difference in the surface striæ that distinguishes it from *I. labradorica* and its variety and *I. stissingensis*. It is the tendency to crenulation of the striæ in nearly all the specimens that have been examined. This in extreme cases goes so far as to approach the surface, so characteristic of *I. pannula*.

The form can not well be identified with the closely related *I. labradorica* or its variety *scantonensis*, or *I. stissingensis*, on account of these peculiar surface characters, and the name *I. alabamaensis* is proposed for it.

In general form of the valves this species is the same as *I. labradorica* and *I. stissingensis*. The specific difference from them, as far as known, is in the surface character. The convexity of the valves is unknown, owing to the compression of the shells in the shale, and we have no information of the area or the pseudodeltidium. It may be that with the obtaining of better material, especially from the limestone, this species will be referred to as a variety of *I. stissingensis*. Shell substance corneous.

Formation and locality.—Middle Cambrian, Coosa Valley shale, Cowan Creek section, Cherokee County, Alabama; also in Rogersville shale, 4 miles northeast of Rogersville, Tennessee, back of Big Creek, southeast of Harlans Knob. (No. 26432, U.S.N.M.)

YORKIA, new genus.

Shell inarticulate, subcircular to suborbicular in outline. Apex of ventral (pedicle) valve perforate, marginal, with a false area and a pseudodeltidium. The cast of the interior of the valve shows a foramen which penetrated obliquely upward and backward through the thick umbonal portion of the shell. Two narrow furrows converge from the side of the foraminal opening toward the longitudinal mesial depression and then diverge toward the antero-lateral portions of the shell.

The dorsal (brachial) valve has a well-defined area and an obscure pseudodeltidium. The interior of this valve has a pair of broad, diverging, shear-shaped furrows passing directly forward from the beak for a short distance and then diverging to the outer margin, but not sufficiently to affect the outward curve of the inner margin.

Shell substance probably calcareous. External surface marked with more or less prominent concentric striæ and lines of growth.

Type.—*Yorkia wanneri*.

The area and pseudodeltidium of the ventral valve resemble the same parts in *Trematobolus insignis*, Matthew,[1] but the foramen is quite different, and generally the interior of the dorsal valve also serves to distinguish the forms. To *Discinopsis*, Matthew,[2] there is a resemblance in the markings of the interior of the dorsal valve. *Discinopsis*, however, is founded upon a small, apparently corneous shell, which so far as known, has no area or pseudodeltidium, and it is closely related to *Acrothele*. *Yorkia* differs from *Acrothele* in its pronounced area, substance of shell, and place of origin of vascular trunks. I do not know of any other genus of the *Siphonotretidæ* with which it can be compared.

[1] Can. Rec. of Sci., V, 1893, p. 277.
[2] Pal. N. Y., VIII, Pt. 1, 1892, p. 105.

YORKIA WANNERI, new species.

(Plate LX, figs. 1, 1*a*–1*c*.)

Shell subcircular to suborbicular in outline, moderately convex, with the apices of the valves marginal. Ventral (pedicle) valve highest at the beak, which is truncated by a circular foraminal opening; cardinal slope angular and slightly incurved, so as to form a narrow false area on each side of the slightly convex, rather broad pseudodeltidium. Numerous casts show the pseudodeltidium, false area, and a large filling or cast of the foramen which extended obliquely backward through the thickened umbonal portion of the shell to the apex. On a cast of the interior of the valve there are two elongated muscular or vascular (probably the latter) impressions that extend from the anterolateral base of the foraminal opening inward to nearly the median line, and then diagonally outward toward the anterior lateral margin of the shell. There is also a slight median longitudinal ridge that corresponds to a depression in the interior of the shell. (Plate LX, figs. 1*b*, 1*c*.) In other casts striæ or lines only are shown radiating outward from the base of the foramen. Fine transverse striæ cross the narrow area and then incurve and cross the pseudodeltidium.

The dorsal (brachial) valve has a well-defined area, with an obscure pseudodeltidium parting it midway. The cast of the interior of the valve shows two broad, shear-shaped diverging ridges that extend from near the apex to the center of the shell. Numerous vascular markings extend outward from the ridges. These ridges may indicate the muscular scars or merely the main trunks of the vascular depressions. The surface of the area is marked by fine transverse striæ that abruptly incurve toward the front of the area, so as to follow along its anterior margin to the pseudodeltidium.

The surfaces of both valves, as shown in the casts, are smooth, except where marked by concentric lines of growth.

Shell substance unknown, but probably calcareous. It is dissolved away in all the specimens in the collection, only the impression of the shell remaining in the decomposed arenaceous limestone.

This species occurs in abundance, associated with *Billingsella festinata*, *Hyolithes americanus*, *Salterella conica*, new species, and fragments of *Olenellus*.

Formation and locality.—Lower Cambrian, York Terrane, on left bank of Codorus Creek, one-eighth of a mile below Meyer's Mill, near Emigsville, 4 miles north of York, Pennsylvania. (No. 26433, U.S.N.M.)

YORKIA? WASHINGTONENSIS, new species.

(Plate LX, fig. 3.)

Ventral (pedicle) valve longitudinally ovate, depressed, convex. Area and pseudodeltidium invisible, but, from the character of the foramen and its resemblance to the foramen of *Y. wanneri*, it is probable

that the area was somewhat similar to the area of that species. The cast of the interior of the ventral valve shows a rather long, large foramen, in advance of which two ridges (vascular trunks) diverge somewhat, as in the ventral valve of *Y. icanneri*. There is also present a short longitudinal depression in the cast, which indicates a corresponding mesial ridge just in advance of the foramen. The surface of the interior of the shell is marked by fine concentric lines and very fine interior ridges. Shell substance apparently corneous.

This species is founded upon two semicasts of the ventral valve, preserved in compact gray limestone. The shell appears to be very thin over the outer portions and thick over the umbonal region.

The generic reference is somewhat doubtful, owing to the close generic relations of *Yorkia*, *Acrothele*, and *Discinopsis*. The foramen and form of the vascular trunks suggest *Yorkia*, while the shell substance and surface characters are more those of *Acrothele*.

Formation and locality.—Lower Cambrian, one-fourth mile east of Salem, Washington County, New York. (No. 26434, U.S.N.M.)

ACROTHELE DECIPIENS, new species.

(Plate LX, fig. 2.)

General form of the ventral (pedicle) valve nearly circular, the length and breadth being nearly the same; moderately convex, most elevated at the apex, which is truncated by a rather large foraminal opening. Cardinal slopes rounded, forming an obscure false area on each side of the flattened pseudodeltidium, which appears to have a slight groove down its center. Surface marked by fine concentric striæ and lines of growth, which pass around back over the area and pseudodeltidium. Shell substance corneous, or it may be phosphatic. The shell has the same appearance as *Acrothele* and *Linnarssonia*.

Only one specimen of this shell was found associated with *Linnarssonia* and fragments of *Olenellus*, in a fine gray limestone interbedded in the Lower Cambrian shale. It resembles quite strongly the ventral valve of *Discinopsis gulielmi*, Matthew, illustrated by Hall and Clarke.[1] It differs, however, in the presence of an obscure pseudodeltidium, and for the present I prefer to place it with *Acrothele* until more is known of the genus *Discinopsis*.

Formation and locality.—Lower Cambrian, York Terrane, 1¼ miles north of Stoner's Station, York and Wrightsville Railroad, York County, Pennsylvania. (No. 26435, U.S.N.M.)

ACROTHELE BELLULA, new species.

(Plate LX, figs. 4, 4*a*–4*e*.)

General form of valves subcircular, moderately convex. Ventral (pedicle) valve highest at the apex and perforated by a circular foramen, in front of which there are two small, short, sharp spines. The

[1] Pal. N. Y., VIII, Pt. 1. 1892, pl. III, fig. 20.

cardinal slope forms a narrow, rounded, obscure false area on each side of a small, low, slightly convex pseudodeltidium. Both the area and the pseudodeltidium are scarcely observable in most specimens. On casts of the interior the pseudodeltidium is more plainly shown (Fig. 4*e*), but the general surface of the exterior of the shell rounds into the false area, with scarcely any line of demarcation. A section of the cast of the ventral valve indicates that it was thin at the margin, increasing in thickness toward the apex, where it was as thick in proportion as in the ventral valve of the *Yorkia wanneri*. The cast Fig. 4*e* shows that on the interior of the shell there is the opening of a large foramen which tapers to a small apex, and that just in advance of the foramen a short median depression occurs, on each side of which a slight elongated tubercle arose. Outside of the tubercle a small, elongated, depressed muscle scar is seen, which was separated from a deep, strongly marked vascular sinus by a very narrow, sharp ridge. The vascular trunks start on the sides of the pseudodeltidium, just back of the foraminal opening, curving around it to the central muscle scars and then extending forward to the center of the shell. Small, round, lateral scars appear to be indicated back of a sharp ridge that bounds the postero-lateral margin of the vascular trunks.

Dorsal (brachial) valve with a nearly transverse hinge line that is considerably narrower than the greatest width of the shell. The cardinal slope forms a rather narrow area, which is broken midway by a low, slightly convex pseudodeltidium. The cast of the interior shows that there was present in the interior of the shell a median ridge that extended from under the beak forward beyond the center of the shell; on each side of the median ridge, beneath the umbonal portion of the shell, a hollow occurs between the ridge and what appears to be a slightly depressed path of advance of a muscle scar. The features described occur upon a siliceous cast preserving the natural convexity of the shell. In a compressed specimen in the shales in which the siliceous nodules occur, the median ridge is well shown, and extends to the center of the shell, where a pair of small anterior muscle scars rest against it. In front of the scars the ridge sends off a number of fine lines or striæ toward the front of the shell; the antero-lateral scars occur on each side of the ridge, about one-half the distance from the beak to the front margin of the shell. The postero-lateral scars are also indicated toward the postero-lateral margin.

Surface of both valves marked by very fine concentric striæ and extremely fine radiating lines of growth. Substance of shell corneous. It is not preserved in the siliceous nodules, but is shown as a black, almost phosphatic shell in the shales.

Formation and locality.—Middle Cambrian, Coosa shales, Cowans Creek, Cherokee County, Alabama. (No. 26436, U.S.N.M.)

DESCRIPTION OF PLATES.

PLATE LIX.

Page.

Fig. 1. *Iphidea superba* 711
1. Dorsal valve. x 3.
1*a*. Summit view of ventral valve. x 6.
1*b*. Posterior view of ventral valve. x 6.
1*c*. Side view of ventral valve. x 6.

2. *Iphidea logani* 711
2. Summit view of ventral valve. x 8.
2*a*. Side view of ventral valve. x 8.
2*b*. Posterior view of ventral valve. x 8.

3. *Iphidea pealei* 712
3. Summit view of ventral valve. x 6.
3*a*. Side view of ventral valve. x 6.

4. *Iphidea crenistria* 713
4. Summit view of ventral valve. x 6.
4*a*. Side view of ventral valve. x 6.
4*b*. Posterior view of ventral valve. x 6.

5. *Iphidea alabamaensis* 713
5. Summit view of a compressed ventral valve. x 6.
5*a*. A small compressed dorsal valve. x 6.
5*b*. Enlargement of the surface side of a portion of the surface of fig. 5.

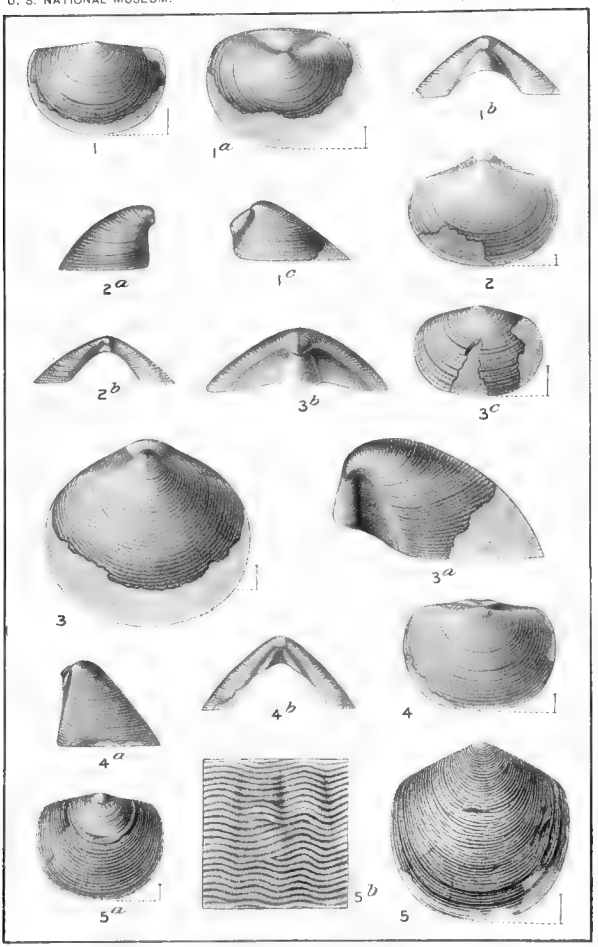
PLATE LX.

Fig. 1. *Yorkia wanneri*, new species 715
1. Exterior of ventral valve, with side outline. x ¾. From cast taken in natural matrix.
1*a*. Natural cast of a ventral valve, with posterior view of area. x 3.
1*b*. Cast of interior of a ventral valve, with side outline. x 2.
1*c*. Enlargement of posterior half of fig. 1*b*.
1*d*. Cast of interior of a dorsal valve, with side outline. x 2.
1*e*. Enlargement of the area and posterior portion of the interior of a dorsal valve. From a cast taken in a natural matrix.

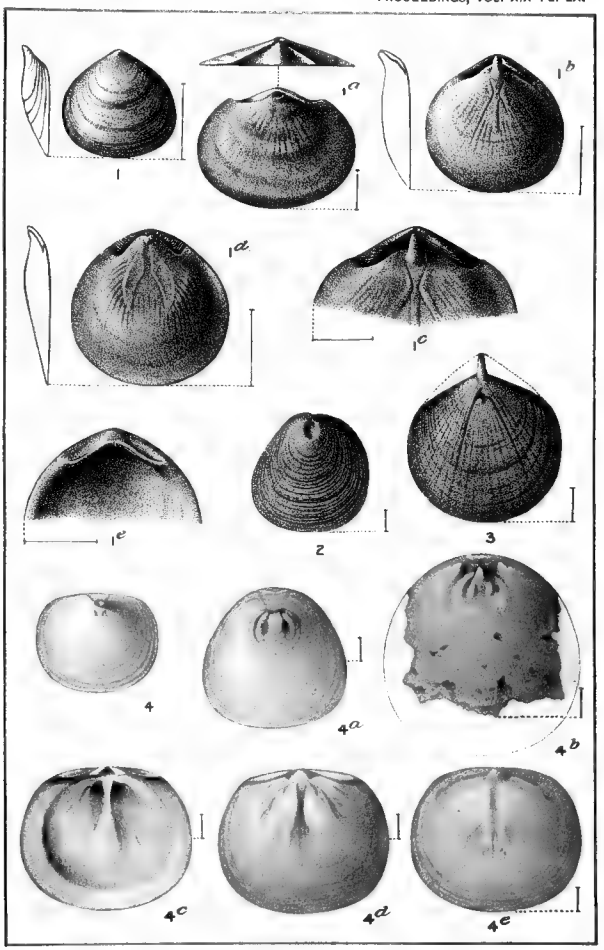
2. *Acrothele decipiens*, new species 716
2. Exterior of a ventral valve. x 6.

3. *Yorkia? washingtonensis*, new species 715
3. Natural semcast of the interior of a ventral valve. x 4.

4. *Acrothele bellula*, new species 716
4. Exterior of a ventral valve. x 6. Taken from cast in a natural matrix in a siliceous nodule.
4*a*. Compressed ventral valve in shale. x 6.
4*b*. Natural cast of the interior of a ventral valve. x 8.
4*c*. Interior of dorsal valve. Taken from a natural cast of the interior occurring in a siliceous nodule. x 6.
4*d*. Natural cast of an interior of a dorsal valve. x 6.
4*e*. Cast of the interior of a dorsal valve occurring in shale. x 6.



CAMBRIAN BRACHIOPODA



CAMBRIAN BRACHIOPODA

DESCRIPTIONS OF SIX NEW MAMMALS FROM NORTH AMERICA.

By EDGAR A. MEARNS, M. D.,
Assistant Surgeon, United States Army.

AMONG the collections of mammals lately made by the writer in the southwestern part of the United States are several forms that appear to be new to science. These are described in the present paper, together with an apparently new species of wood rat, sent to me for determination by Doctor J. A. Allen, curator of mammals in the American Museum of Natural History, New York.

THOMOMYS FULVUS INTERMEDIUS, new subspecies.

INTERMEDIATE POCKET-GOPHER.

Type.—No. $\frac{21473}{36697}$, U.S.N.M. (Collection International Boundary Commission). Adult male, from the aspen and spruce zone at the summit of the Huachuca Mountains, Arizona; altitude, 9,000 feet. Collected by Mr. F. X. Holzner, September 6, 1893. Original number, 1013.

Description of type.—Slightly smaller than *Thomomys fulvus*, equaling *T. peregrinus*. General color mars brown, with a broad dorsal area of plumbeous black extending from nose to rump. Feet and tail soiled white. When the pelage is worn, the plumbeous underfur shows through between the tips of the hairs of the under surface. Length, 220 mm.; tail, 66; hind foot, 24. Skull, 31.5 by 22.

Geographical range.—The Boreal Zone of the chain of mountains connecting the Colorado Plateau with the Plateau of Mexico.

Remarks.—This form is intermediate between *Thomomys fulvus* (Woodhouse) and *T. peregrinus*, Merriam, though in some respects peculiar.

DIPODOMYS MITCHELLI, new species.

TIBURON ISLAND KANGAROO RAT.

Two specimens of a new kangaroo rat, closely related to *Dipodomys merriami simiolus*, Rhoads, have recently been sent me by Mr. J. W. Mitchell, who trapped them on Tiburon Island, in the Gulf of California, Mexico. Mr. Mitchell has, for some time past, been engaged in making

explorations in western Sonora, and visited Tiburon Island in company with Mr. W J McGee, of the Bureau of Ethnology, in December, 1895. With a meager supply of traps, Mr. Mitchell succeeded in capturing two species of small mammals—a *Dipodomys* and a *Peromyscus*—both of which differ from the forms found on the adjacent mainland of Sonora, though plainly showing that they originated from them.

Type.—No. 63188, U.S.N.M. (Collection International Boundary Commission). Adult female, skin and skull, from Tiburon Island, Gulf of California, Mexico. Collected by Mr. J. W. Mitchell, December 23, 1895. Original number, 3.

Description of type.—Similar to *Dipodomys merriami simiolus*, Rhoads, but slightly smaller, with much shorter ears and stronger coloration. As in the case of the Tiburon Island mouse, described beyond, the tail is much more heavily coated than that of the corresponding mainland species; the dark band on its upper and under surfaces being jet black in *D. mitchelli*, mostly light drab in *D. m. simiolus*. The ears are more densely clothed than in *D. m. simiolus*, and are almost black instead of buffy white. The dark stripe on the under side of the hind foot of *D. merriami* (typical) is obsolete in the subspecies *simiolus*, but in the present species reappears, and it is intensely black. The body is colored like *simiolus*, except that the sides are more of an ochraceous buff, and the back has more black admixed; the under pelage having a darker slate color. The tail is bushier at the extremity than in the several forms of *D. merriami*.

A second specimen (No. 63187, U.S.N.M., adult male) agrees in size and coloration with the type. Length of tail vertebræ, 140 mm., hind foot, 38.5; skull, 36.5 by 22.5; nasal bones, length, 13.3.

Remarks.—I have compared this insular form with *Dipodomys merriami melanurus*, described by Doctor Merriam[1] from San José del Cabo, Lower California, and found it to be quite different. It is easily distinguished from it by its paler and different coloration, and by the smaller amount of black on the tail.

PEROMYSCUS TIBURONENSIS, new species.

TIBURON ISLAND DESERT MOUSE.

Type.—No. 63186, U.S.N.M. (Collection International Boundary Commission). Adult male, skin and skull, from Tiburon Island, Gulf of California, Mexico. Collected by Mr. J. W. Mitchell, December 25, 1895. Original number, 1.

Description of type.—Smallest of the desert mice, its hind foot measuring but 19 mm., and ear from notch, 16; skull, 24 by 12 mm. Color above, drab gray, thickly mixed with black; sides, ochraceous cinnamon; under parts white; ears purplish black, almost naked; tail quite densely coated with blackish hairs. Compared with *Peromyscus eremi-*

[1] Proc. Cal. Acad. Sci., 2 ser., III, June 5, 1893, p. 345.

cus its skull is smaller, higher posteriorly, narrower and depressed anteriorly. The audital bullæ are much less developed, and the incisive foramina and interpterygoid fossa wider. The teeth are considerably smaller. This species was taken on Tiburon Island by my friend, Mr. J. W. Mitchell, who accompanied Mr. McGee, of the Bureau of Ethnology, on his exploration in the region inhabited by the Seri Indians, during the season of 1895–96. This insular form was evidently derived from the *Peromyscus eremicus* of the adjacent mainland, from which it differs in being much smaller, with a darker coloration, more hairy tail, and in having certain cranial peculiarities.

PEROMYSCUS STEPHENSI, new species.

PALM DESERT MOUSE.

Type.—No. 61026, U.S.N.M. (Collection International Boundary Commission). Adult female, skin and skull, from the lowest water, on the wagon road, in a canyon, at the eastern base of the Coast Range Mountains, San Diego County, California, near the Mexican boundary line. Collected by Doctor Edgar A. Mearns, May 9, 1894. Original number, 3512.

Description of type.—Similar externally to *Peromyscus eremicus*, but smaller, with a longer tail and much paler coloration. Upper surface grayish cream buff, deepening to a pale ochraceous buff on sides and rump; tail slightly dusky above, white below, hairy at end; feet and under surface white; whiskers mostly colorless; ears and soles naked, the former slightly pubescent. Length, 193 mm.; tail vertebræ, 108 (to end of hairs, 114); ear from crown, 16; ear from notch, 18.5; distance between eyes, 8; diameter of eye, 3.8; length of longest whisker, 39; from tip of nose to eye, 11.8; to center of pupil, 14; to ear, 20; to tip of ear, 40; to occiput, 26.5; to end of outstretched hind limb, 125; fore limb, measured from olecranon to end of longest claw, 21; length of hand, 9.7; its longest claw, 1.4; hind limb, measured from knee-joint to end of longest claw, 38; length of hind foot, 19; longest claw of pes, 1.7. The skull is strongly depressed anteriorly, with the rostrum produced and the nasals projecting. The zygomatic arches are incurved and convergent anteriorly to meet the sloping zygomatic processes, this feature recalling the configuration of young skulls of the other species of *Peromyscus* in which the brain-case has outgrown the face, though in this case we have the opposite condition, the facial portion being unusually elongated. Named for Mr. Frank Stephens, of California.

NEOTOMA ATTWATERI, new species.

ATTWATER'S WOOD RAT.

Doctor J. A. Allen recently sent me seven skins and five skulls of what proves to be a new species of *Neotoma*, with permission to compare them with the material in the United States National Museum

and determine them, as he was of the opinion that they were not *Neotoma mexicana* to which he had previously with much doubt provisionally referred them. This surmise is quite correct. The specimens in question represent a wholly different group of round-tailed wood rats, not closely related to *N. mexicana* or to any of the western species of the Mexican boundary region. A glance suffices to show that it is not the Texan wood rat (*N. micropus*, Baird). In coloration it resembles *N. leucodon* of Merriam, from farther south, in San Luis Potosi, Mexico; but it is less reddish, and has smaller ears than that species. Compared with *N. leucodon*, its skull exhibits important differences in the size and shape of the post-palatal notch, in the teeth, and in the much greater length of the nasal bones and rostrum. Comparison with the members of the *N. floridana* group from the neighboring States—Louisiana, Mississippi, Indian Territory, and Kansas—shows it to be a closely related form. The skull, including the teeth, agrees almost exactly with *N. floridana*. Externally it differs only in having a softer and finer coat, a much more hairy tail, and a paler and grayer coloration Members of the *floridana* group have been described from Nebraska and Kansas, under the names *Neotoma baileyi*, Merriam,[1] and *N. campestris*, Allen.[2] From these, *N. attwateri* differs in several minor cranial characters, as well as in the color and texture of the furry coat. It is not improbable, however, that all of these forms may prove to be but geographic races of *N. floridana*.

Type.—No. $\frac{11964}{10402}$, Am. Mus. Nat. Hist. Adult female, collected December 10, 1895, at Lacey's ranch ("high land, covered with oak, and rocky"), on Turtle Creek, Kerr County, Texas, by Mr. H. P. Attwater. Original number, 113.

Description.—No. 12294 (Collection of the American Museum of Natural History, New York) is a fine old male, in perfect winter pelage, killed February 3, 1896. The ears are small, like those of *N. floridana*. Tail well covered with hair. Pelage long, dense, and soft. Upper surface of body ochraceous buff, mixed with grayish above and strongly lined with black; sides clearer ochraceous buff. Outer surface of limbs light gray. Under surfaces creamy white. Feet all white but the heel, which is light plumbeous. Whiskers black or colorless, and very long (80 mm.). Upper side of head smoke gray. The under pelage is dark plumbeous on the upper and white on the lower side of the body. The tail, which is sharply bicolored, is mouse gray above and white below.

The type is patchy, having small areas of smoke gray in the general yellowish brown of the upper surface. Mr. Attwater's measurements are: Length, 387 mm.; tail vertebræ, 178; hind foot, 39.4.

Half-grown young are smoke gray above, drab gray on the sides, and white below; upper side of tail, mouse gray.

The skull of the type measures 52 by 27 mm. in its greatest diameters.

[1] Proc. Biol. Soc. Wash., IX, July 2, 1894, p. 123.

[2] Bull. Am. Mus. Nat. Hist., VI, November 7, 1894, p. 322.

It is similar in shape, and in its dental characters, to that of *Neotoma floridana*, from which it differs only in being rather high in the frontal region, with the zygomatic arches more prominent posteriorly. The five skulls examined have a prominent crest on the basioccipital bone, which is absent in *N. floridana*. The rostral portion of the skull is as long as that of *N. floridana*, the nasal bones measuring 20 mm. in length. The teeth agree closely with those of *N. floridana*.

For the materials used in making these comparisons I am indebted to Doctor C. Hart Merriam and the authorities of the United States National Museum.

This species is named in honor of Mr. H. P. Attwater, of San Antonio, Texas.

ERETHIZON EPIXANTHUS COUESI, new subspecies.

ARIZONA PORCUPINE.

In 1887 I collected a small porcupine in the Mogollon Mountains of central Arizona, which differed in important respects from both the Canadian porcupine (*Erethizon dorsatus*) and the Pacific Coast species (*Erethizon epixanthus*); but owing to the lack of materials for a satisfactory comparison, I abstained from naming the new form. At the present time, owing largely to the efforts of Mr. Frederick W. True, curator of the department of mammals, the United States National Museum is possessed of a very respectable series of American porcupines from localities extending from Labrador to Pennsylvania in the East, and from Alaska to Arizona in the West. The Arizona porcupine differs so widely from *E. dorsatus* that comparison is unnecessary. *E. epixanthus* was described by Brandt[1] from five specimens from the west coast of North America (California and Unalaska) in the museum at St. Petersburg. The fine series of skins and skulls from Alaska and northern California, collected by Messrs. McKay, Townsend, True, Prentiss, and others, furnish excellent material for comparison of the Arizona form with true *Erethizon epixanthus*, which latter is a much larger, yellower, and more richly colored animal.

The name *Hystrix pilosus*, applied by Doctor Woodhouse to the porcupine of New Mexico,[2] is preoccupied by the *Hystrix pilosus* of Richardson.[3]

For reasons not apparent, Gray's name, *Erethizon* (*Echinoprocta*) *rufescens*, based on an animal from "Columbia," has long figured in our mammalogies as a synonym of *Erethizon epixanthus* Brandt.

Having exhausted the list of synonyms without finding a name that can be applied to the Arizona porcupine, I take pleasure in naming it in honor of Doctor Elliott Coues, who collected the type specimen (No. $\frac{7814}{6501}$, U.S.N.M.), at Fort Whipple, Arizona.

[1] Mém. Acad. St. Petersburg, 1835, IX, pl. 1 (animal), figs. 1–4 (skull).

[2] Sitgreaves's Expedition down the Zuñi and Colorado Rivers, 1853, p. 54.

[3] Fauna Boreali-Americana, I, 1829, p. 214.

Description.—Smaller than *Erethizon epixanthus*, with larger external and internal organs of hearing and a much paler and duller coloration. Dorsum covered with white quills, which are narrowly pointed with brown and mixed with very long and rigid hairs, many of which are broadly tipped or banded at base with whitish; color darkest on middle of rump. Muzzle, feet, and under surface of body, brown, with more or less admixture of gray-tipped hairs.

Two specimens (Nos. $\frac{348}{1263}$ and $\frac{349}{1263}$, U.S.N.M.) collected by Doctor C. B. R. Kennerly, on Bill Williams's Fork, an Arizona tributary of the Colorado River, are in good winter coat, having been killed in December or January of the year 1853 or 1854. The long, coarse hair is yellowish instead of grayish white, and the quills of the dorsal surface are concealed by dense, woolly underfur, which is absent in the Fort Whipple specimen, which appears to have been killed in summer. A specimen collected by the writer in the Mogollon Mountains, Yavapai County, Arizona (No. 2404, Collection of the American Museum of Natural History, New York), agrees with the above except that it is paler and grayer, having a dusty appearance.

Cranial characters.—The skull shows the type specimen to have been nearly adult, the teeth being mature, although the cranial sutures are quite evident and the osseous crests but slightly developed. Selecting for comparison a specimen of similar age from northern California, collected by Mr. Charles H. Townsend, the most striking difference, aside from the much larger size of the California specimen—which measures 98 mm. in total length against 86 in the type of the subspecies *conesi*—is the enormous development of the audital bulla in the Arizona animal, in which it measures 21 by 16.7 mm. against 19 by 15 in the Californian. Other skulls from Arizona and New Mexico bear out these characters, though I am unable to detect any other cranial differences. None of the specimens examined were measured when fresh.

THE FOOD PLANTS OF SCALE INSECTS (COCCIDÆ).

By T. D. A. COCKERELL.
Entomologist of the New Mexico Agricultural Experiment Station.

Introduction.—It is not pretended that the following summary is complete; to make it so would involve a much more elaborate search through the scattered literature than the writer has now opportunity for; and even then, a few months would inevitably bring new records, and make it incomplete again. It is, however, hoped that the summary will be of service, as bringing together the great majority of the records, and indicating to the horticulturist what scale insects he may expect to find on any given plant or group of plants. While it can not be regarded as valid negative evidence, it presents a large mass of facts which are of great importance from several points of view. Two practical points may be emphasized—one, the unexpected number of coccids found on many of the cultivated trees and shrubs; and the other, the frequency with which species dangerous to fruit trees will occur on ornamental plants, which may be carried from place to place and be the means of disseminating the scales.

In preparing the summary, it has been found in many cases necessary to correct the names of the plants given by writers on Coccidæ. It is much to be desired that entomologists should be more careful to correctly cite the names of plants they have occasion to mention.

A card catalogue of host plants of Coccidæ is in preparation, and may be seen at the United States Department of Agriculture. It may be possible some day to complete it and publish a second and complete edition of the present essay. Such a second edition would be much larger than the present, for not only would it contain all the scattered records of the past, but very numerous additions, which will be found in Green's forthcoming monograph of the Coccidæ of Ceylon, and other works projected or in preparation.

It must of course be understood that the plants given as the hosts of Coccidæ have been in very many cases so infested only since they came into cultivation. It would be very desirable to distinguish in every case between the endogenetic and exogenetic coccids on a plant; and also between those exogenetic in a state of nature, and those only so in cultivation. But to do this would require more information than we at present possess.

The abbreviations used will be understood by all coccidologists; but it may be mentioned that "Sign. Essai" is Signoret's "Essai sur les Cochenilles," "Comst., 2d Cornell Rep." is Comstock's 1883 report as entomologist of Cornell University Experiment Station, "Tr. N. Z. Inst." is the Transactions of the New Zealand Institute, and "Scale Ins. N. Z." is Maskell's work on the Scale Insects of New Zealand.

RANUNCULACEÆ.

Dactylopius destructor Comstock (= *citri* Risso) has been found on the garden *Paonia*. (Howard, Bull. 5, Div. Ent., U. S. Dept Agric., p. 17.) Sasaki records *Diaspis patelliformis* from *P. moutan*.

DILLENIACEÆ.

A small order of tropical and Australian trees and shrubs. *Hibbertia*, much the largest genus, contains a number of species cultivated in greenhouses.

H. linearis, Robert Brown, and *H. virgata*, Robert Brown, both natives of Australia, are the food plants of *Dactylopius hibbertiæ*, Maskell. This is a dark purple mealy bug, resting on a cushion of yellow cotton.[1]

MAGNOLIACEÆ.

Trees of Asia and North America, with some representatives in South America. In Australia and New Zealand the order is represented only by a few species of *Drimys*; *D. colorata*, Raoul, in New Zealand, supports *Mytilaspis drimydis*, Maskell, and *Inglisia patella*, Maskell. Comstock quotes Maskell as to *Mytilaspis cordylinidis*, Maskell, being also found on *Drimys*. Two species of the genus, at least, occur in cultivation.

Coquillett records the exogenetic *Aspidiotus nerii*, Bouché, on the North American *Magnolia fœtida*, Linnæus (*grandiflora*, Linnæus).

Lecanium tulipifera, Cook, which is very likely the same as the undescribed *Coccus liriodendri* of the last century, infests *Liriodendron tulipifera*, Linnæus.

The Asiatic Magnoliaceæ certainly should be searched for Coccids.

ANONACEÆ.

A large order of tropical trees, several being valuable for their fruit. The Sweet Sop, *Anona squamosa*, Linnæus, is a native of tropical America, and in Jamaica is infested by *Lecanium hemisphæricum*, Targioni-Tozzetti, and *Dactylopius virgatus*, Cockerell. It has also been taken for the sake of its fruit to India, where it becomes a food plant of *Tachardia lacca*, Kerr[2] and the unrecognizable *Coccus trichodes*, Ander-

[1] Tr. N. Z. Inst., XXIV, p. 32.
[2] Watt, Dict. Ec. Prod. India.

son. The Sour Sop, *Anona muricata* Linnæus, is a small tree, native of the West Indies; on it are found *Lecanium hemisphæricum*, Targioni-Tozzetti, and *Ceroplastes denudatus*, Cockerell. *Anona cherimolia*, Miller (syn. *tripetala*), is also neotropical, but in Fiji it supports *Lecanium chirimoliæ*, Maskell, which, however, is now considered a synonym of the wide-spread *L. longulum*.

The lancewood of Jamaica (*Bocagea*) is the host plant of *Ceroplastes jamaicensis*, White.

MENISPERMACEÆ.

A large order of tropical climbing plants. *Tinospora* (olim *Menispermum*) *cordifolia* is recorded as supporting the unrecognizable *Coccus oogenes*, Anderson, in India.

BERBERIDEÆ.

The palæarctic *Berberis vulgaris* is the food plant of *Lecanium berberidis*, Schrank.

CRUCIFERÆ.

A boreal species, *Arabis stricta*, produces *Asterolecanium arabidis*, Lichtenstein.

CISTINEÆ.

Lecaniodiaspis sardoa, Targioni-Tozzetti, is found upon *Cistus*.

VIOLACEÆ.

Cultivated violets in Jamaica are infested by *Dactylopius virgatus*, Cockerell, and *Orthezia insignis*, Douglas. In New Zealand *Melicytus ramiflorus*, Forster, produces *Chionaspis dysoxyli*, Maskell; and *Hymenanthera crassifolia*, Hooker, is the food of *Ctenochiton hymenantheræ*, Maskell; *Diaspis santali*, Maskell, occurs on *Melicytus*.

PITTOSPOREÆ.

Pittosporum is a comparatively large genus of small trees and shrubs, with often fragrant flowers. Maskell records *Fiorinia astelia*, Maskell, on the New Zealand *P. tenuifolium*, Gaertner; and *Eriococcus paradoxus*, Maskell, and *Parlatoria pittospori*, Maskell, on the Australian *P. undulatum*, Ventenat. He also records from *Pittosporum*, species not stated, *Ctenochiton perforatus*, Maskell, *C. viridis*, Maskell, and *Dactylopius glaucus*, Maskell. In cultivation in this country the species of *Pittosporum* seem rather subject to the attacks of exogenetic coccids; Coquillett mentions *Icerya purchasi*, Maskell, and *Lecanium hesperidum*, Linnæus.

Bursaria consists apparently of only two species, one in Australia, the other in the Philippine Islands. The former, *B. spinosa*, is infested by *Eriococcus eucalypti*, Maskell, and *E. tepperi*, Maskell.

CARYOPHYLLEÆ.

In Europe *Stellaria holostea* supports, in common with various other low plants, *Orthezia urticæ*, Linnæus.[1]

TAMARISCINEÆ.

A small order, best known by the Old World genus *Tamarix*, common in cultivation. *T. gallica* of Mount Sinai and other localities produces the *Gossyparia mannifera*, Hardwick. In cultivation, I have found the tamarisk free from coccids, but Coquillett records *Icerya purchasi*, Maskell, exogenetically upon it.

Fouquiera splendens, one of the most curious native plants of New Mexico and northern Mexico, commonly used for hedges, is rarely found infested by *Dactylopius townsendi*, Cockerell.

HYPERICINEÆ.

The unrecognizable *Coccus hypericonis*, Gmelin, is recorded from the European *Hypericum perforatum*.

GUTTIFERÆ.

A large order of tropical trees and shrubs, mostly American and Asiatic. *Clusia alba*, Jacquin, is attacked by *Icerya montserratensis*, Riley and Howard, in Trinidad. *Mammea americana*, Linnæus, is cultivated in the Sandwich Islands, and there infested by *Pulvinaria mammeæ*, Maskell, which, however, may be exogenetic. At any rate, no such *Pulvinaria* has been found on the mammee in the West Indies.

TERNSTRŒMIACEÆ.

Another fairly large order, well known from the camellia and tea plant, both now referred to the genus *Camellia*. *Schima crenata* is cited as a food plant of *Tachardia lacca*, Kerr. The common camellia, *C. japonica*, a native of Japan and China, is much attacked by scale insects in cultivation. The list is *Aspidiotus spinosus*, Comstock, *A. rapax*, Comstock, *A. degeneratus*, Leonardi, *Fiorinia fioriniæ* var. *camelliæ*, Comstock, *Parlatoria pergandei*, Comstock, var. *camelliæ*, Comstock, *Pulvinaria camellicola*, Signoret, *Lecanium hesperidum*, Linnæus, *L. oleæ*, Bernard, *L. hemisphæricum*, Targioni-Tozzetti. *Chermes camelliæ* of Boisduval can not now be identified; it can not well be what Signoret called *Aspidiotus camelliæ*, which is *A. rapax*. Boisduval's insect was also found on the tea plant. *Aspidiotus duplex*, Cockerell, was found by Mr. Ehrhorn on camellia from Japan, at a Japanese nursery in San Francisco. *Ceroplastes ceriferus*, Anderson, was found by Mr. Craw on

[1] Douglas, Trans. Ent. Soc. Lond., 1881, p. 298.

camellia from Japan, and sent to me by Mr. Ehrhorn. The tea plant, *Camellia theifera*, also produces several coccids. Maskell reports from it *Ceroplastes ceriferus*, Anderson, and in America Comstock records *Ceroplastes floridensis*, Comstock. Mr. E. C. Cotes has published[1] a useful account of the insects which attack the tea plant in India; the coccids he gives as follows: *Chionaspis theæ*, Maskell, *Aspidiotus flavescens*, Green (syn. *A. theæ*, Maskell), *A. transparens*, Green, *Lecanium coffeæ*, Nietner. Green has recorded that *Lecanium viride*, Green, is occasionally found upon tea. According to Green in a letter to the writer, also, his *Aspidiotus flavescens* is a *Diaspis*, and therefore not identical with *Aspidiotus theæ*, Maskell, which is a valid species. *Parlatori atheæ*, Cockerell, occurs on the tea plant in Japan.

DIPTEROCARPEÆ.

An order of tropical trees. Two species of *Shorea* are infested by *Tachardia lacca*, Kerr, in India.

MALVACEÆ.

A world-wide order, made familiar by such plants as cotton and *Hibiscus*. *Plagianthus* and *Hoheria* are antipodean genera; the former supports *Ctenochiton depressus*, Maskell, the latter, *Eriococcus hoheriæ*, Maskell, *Fiorinia stricta*, Maskell, and *Chionaspis dysoxyli*, Maskell. The species of the latter genus is *H. populnea*, A. Cunningham (syn. *angustifolia*, Raoul). The Indian *Kydia calycina*, Roxburgh, is one of the food plants of *Tachardia lacca*, Kerr. The forms of *Abutilon* in cultivation offer exogenetic coccids; thus Lounsbury reports *Orthezia insignis*, Douglas, Coquillett *Lecanium oleæ*, Bernard, and Gillette and Baker give a record of *Lecanium hesperidum*, Linnæus. In England, Newstead found *Lecanium minimum*, Newstead. *Malva-viscus* also is infested by *Othezia insignis*, Douglas; while in Mexico *M. arboreus*, Cavanilles, and *M. acerifolius*, Presl, support *Ceroplastes ceriferus*, Anderson (syn. or var. *dugesii*). The latter insect was found by Professor Townsend at Cuautla, Mexico, on *Hibiscus*.

The various varieties of cultivated *Hibiscus* are decidedly subject to coccid attacks. In the West Indies they suffer especially from *Lecanium depressum*, Targioni-Tozzetti; but also from *Chionaspis minor*, Maskell, of which there is a curious variety having the habit of burrowing under the epidermis; this was found by Mr. Barber in Antigua. The ordinary form of *C. minor* is sometimes excessively abundant on the plants. *Aspidiotus articulatus*, Morgan, occurred on an *Hibiscus* labeled *H. purpureus* forma *semiplena;* I am not clear whether this was *H. purpureus*, Forster, which is not cited in Nicholson's Dictionary of Gardening, or *H. syriacus*, Linnæus forma *purpureus* Hortorum. According to Riley, *Asterolecanium pustulans*, Cockerell, is found on *Hibiscus* in

[1] Ind. Mus. Notes, 1895.

Florida. In Tampico, Mexico, Townsend found a variety of *Conchaspis angraci*, Cockerell, on *Hibiscus*. There are, in addition, several quite problematical species reported from the same genus of plants: *Pulvinaria cestri*, Bouché, *Lecanium bromeliæ*, *Coccus erion*, Anderson, and *C. trichodes*, Anderson. The last two are from *H. rosa-sinensis*. *H.* (*Abelmoschus*) *esculentus*, Linnæus, is a food plant of *Diaspis amygdali*. The unidentified *Coccus oogenes*, Anderson, lives on *Thespesia* (olim *Hibiscus*) *populnea*, Linnæus. In Jamaica the cotton (*Gossypium barbadense*) grown about the town of Kingston becomes infested by *Dactylopius virgatus*, Cockerell, *Chionaspis minor*, Maskell, and *Diaspis amygdali*, Tryon. In China, on cotton, is the unrecognized *Diaspis* or rather *Chionaspis gossypii*, Fitch.

Professor C. H. T. Townsend wrote me from Brownsville, Texas, April 8, 1895:

I mail you herewith some scales I found on cotton the other day. They are all I have. Could find no more. It is the first scale I have ever found on cotton.

The material was very scanty, but with little doubt belonged to *Lecanium imbricatum*, Cockerell. Professor Townsend had the following note on the fresh specimens:

Liver-colored, very convex, oblong, with a broken longitudinal carina. Scale transversely and rather irregularly ribbed on sides. The broken keel shows a whiter surface than the rest. Length of large scale, 4½ mm.; width, 3 mm.; height 2 mm. or slightly over. Smallest scale is 1½ mm. long.

STERCULIACEÆ.

A large order of tropical herbs and trees. The Indian *Eriolæna hookeriana*, Wight and Arnot, is a food plant of *Tachardia lacca*, Kerr. Comstock records *Lecanium oleæ*, Bernard, from "*Brachaton*," meaning perhaps *Brachychiton*. Sasaki reports *Diaspis patelliformis*, Sasaki, from *Sterculia platanifolia*.

TILIACEÆ.

A cosmopolitan order of over three hundred species. *Grewia excelsa*, Vahl (syn. *rothii*), a native of the oriental and Ethiopian tropics, exhibited some exogenetic *Ceroplastes floridensis* when cultivated in Jamaica. *Triumfetta rhomboidea*, Jacquin, also in Jamaica, nourished some *Ceroplastes ceriferus*, Anderson.[1]

The temperate-zone genus *Tilia* supports several coccids, namely *Aspidiotus ancylus*, Putnam, *A. tiliæ*, Signoret, *Mytilaspis pomorum*, Bouché, *Pulvinaria innumerabilis*, Rathvon, *Lecanium tiliæ*, Cook, *Xylococcus filiferus*, Loew, and the problematical *Lecanium ragabundum*, Kaltenbach. The species of *Tilia* infested is not in every case clear. *L. tiliæ* and *X. filiferus* are from *T. grandifolia*, more correctly called *T. platyphyllos*, Scopoli. *Aspidiotus tiliæ* and *Mytilaspis linearis* (*pomo-*

[1] Amer. Nat., 1895, p. 731.

rum) have occurred on the same, recorded by Signoret as *T. platyphylla*. Signoret also gives *M. linearis* as from *T. sylvestris* and *L. tiliæ* from *T. communis*, which is, I suppose, *T. vulgaris*, Hayne.

Apeiba tibourbou, Aublet, a native of Guiana and Venezuela, exhibits a few *Aspidiotus personatus*, Comstock, and *A. articulatus*, Morgan, when cultivated in Jamaica.

The New Zealand *Elæocarpus dentatus* supports, according to Maskell, *Ctenochiton elæocarpi*, Maskell, *C. flavus*, Maskell, *Inglisia ornata*, Maskell, and *Eriococcus pallidus*, Maskell. The Australian *E. cyaneus*, Sims, in cultivation in this country, has yielded *Chionaspis bicolaris*, Comstock, as reported by Comstock.

ZYGOPHYLLEÆ.

A small and diverse order of herbs, shrubs, and trees. In Jamaica *Dactylopius virgatus*, Cockerell, is found upon *Tribulus cistoides*. The *Larrea divaricata* or *mexicana* of the arid region of North America exhibits in Arizona *Tachardia larreæ*, Comstock, and in the Mesilla Valley of New Mexico *Icerya rileyi*, Cockerell, and *Dactylopius townsendi* var. *steclii*, Cockerell. It is curious that I have never been able to find *T. larreæ* in New Mexico, though the *Larrea* is so abundant.

In Jamaica the beautiful lignum-vitæ tree (*Guaiacum officinale*) is a food plant of *Ceroplastes cirripediformis*, Comstock, *C. floridensis*, Comstock, *C. depressus*, Cockerell, *Icerya rosæ*, Riley and Howard (under the bark), *Lecanium oleæ*, Bernard (rarely), *Aspidiotus aurantii*, Maskell, and a *Lecanium* heretofore presumed to be *tessellatum* but probably distinct.

GERANIACEÆ.

Cultivated Pelargoniums are especially liable to the attacks of *Diaspis amygdali*, Tryon, but may also be infested by *Pseudoparlatoria ostreata*. Lounsbury reports *Orthezia insignis*, Douglas, on *Pelargonium*, as also on *Oxalis*. Comstock records *Orthezia americana*, Walker, from *Impatiens*.

RUTACEÆ.

A large order of shrubs and trees, most numerous in South Africa and Australia, best known by the orange.

The African genus *Diosma* has been found attacked by the exogenetic *Aspidiotus rapax*, Comstock, or *camelliæ*, Signoret.[1] *Diosma crenata* is reported as supporting the problematical *Coccus diosmatis*, Modeer; this plant, however, is not a *Diosma*, but a *Barosma*, *B. crenulata*, Linnæus. The New Zealand *Melicope ternata*, Forster, furnishes *Eriochiton spinosus*, Maskell. The hop tree, *Ptelea trifoliata*, Linnæus, is cited by Comstock as one of the various food plants of *Mytilaspis pomorum*, Bouché. *Murraya exotica*, when cultivated in Jamaica, is infested by

[1] Maskell, Tr. N. Z. Inst., XXVII, p. 39.

Aspidiotus articulatus, Morgan, and *Mytilaspis citricola*, Packard. The Indian *Feronia elephantum*, Correa, is a food plant of *Tachardia lacca*, Kerr.

The Coccidæ of *Citrus* trees are about to be treated in full by Mr. Hubbard, but a list of the species may be here given:

(1) *Chionaspis citri*, Comstock. On lime (Amer. Nat., 1895, p. 728); on mandarin orange (Maskell, Tr. N. Z. Inst., XXV, p. 211.) Well known as a pest of *Citrus* trees in this country and some of the West Indian islands.

(2) *Chionaspis latus*, Cockerell. On orange leaves, Tokyo, Japan (Takahashi). Allied to *C. aspidistræ* and *C. braziliensis*.

(3) *Howardia biclavis*, Comstock. On orange stem from Tahiti, found by Mr. Craw in his quarantine work; sent by Mr. Ehrhorn.

(4) *Parlatoria pergandei*, Comstock. Well known in the south, and west to Matamoras, Mexico (Townsend).

(5) *Parlatoria zizyphus*, Lucas. Found on lemons.

(6) *Mytilaspis citricola*, Packard (*fulva*, Targioni-Tozzetti, *flavescens*, Targioni-Tozzetti). Perhaps the most widely spread and common of orange coccids. I am indebted to Mr. Hubbard for calling my attention to the identity of *M. flavescens* with *M. fulva*.

(7) *Mytilaspis gloverii*, Packard. Frequent in the South, extending also to Tampico and Matamoras, Mexico (Townsend). Mr. Takahashi has found on orange at Tokyo, Japan, a form which seems to me to be only a rather broad variety of *gloverii*.

(8) *Aspidiotus ficus*, Ashmead. Common on *Citrus* trees in the warm parts of America.

(9) *Aspidiotus scutiformis*, Cockerell. On *Citrus* in Victoria and Monterey, Mexico (Townsend).

(10) *Aspidiotus articulatus*, Morgan. On *Citrus* trees in the West Indies.

(11) *Aspidiotus duplex*, Cockerell. Found by Mr. Craw on orange trees from Japan.

(12) *Aspidiotus albopunctatus*, Cockerell. Found by Mr. Craw on orange seedlings from Japan. Hardly different from *A. perniciosus*.

(13) *Aspidiotus aurantii*, Maskell. A well-known orange pest, especially in California. It has a variety *citrinus*, Coquillett.

(14) *Aspidiotus nerii* var. *limonii*, Signoret. On lemons in the south of Europe. Specimens of *nerii* are often found on lemons exposed for sale in this country, but probably of European origin.

(15) *Aspidiotus rapax*, Comstock. Recorded from orange by Coquillett, as also *A. convexus*.

(16) *Aspidiotus longispinus*, Morgan. Maskell reports this on China orange from the Sandwich Islands. (Tr. N. Z. Inst., XXVII, p. 38.)

(17) *Aspidiotus cydoniæ*, Comstock. According to Maskell, this is found on orange in Samoa.

(18) *Pulvinaria tecta*, Maskell. On *Citrus*, etc., in Australia.

(19) *Pulvinaria aurantii*, Cockerell. On orange, Tokyo, Japan (Takahashi).

(20) *Lecanium punctatum*, Cockerell. On *Citrus medica* var. *acida* in Grenada.

(21) *Lecanium oleæ*, Bernard. The well-known black scale. *L. citri*, Inzenga, appears to be the same.

(22) *Lecanium hesperidum*, Linnæus. Also a common species on *Citrus* trees, though not everywhere.

(23) *Lecanium longulum*, Douglas. Maskell reports this from *Citrus*.

(24) *Lecanium hemisphæricum*, Targioni-Tozzetti. Affects *Citrus* trees as well as many other plants. Coquillett records the variety *hibernaculorum*, Boisduval.

(25) *Ceroplastes cirripediformis*, Comstock.

(26) *Ceroplastes floridensis*, Comstock. This and the last are reported by Comstock.

(27) *Orthezia insignis*, Douglas. On orange, see Amer. Nat., 1895, p. 727. Also on lime.

(28) ***Phenacoccus yuccæ***, Coquillett. Found by Professor Townsend in Mexico, on lime in San Luis Potosi, and on orange in Guadalajara.

(29) ***Phenacoccus barberi***, Cockerell. On orange, etc., representing *yuccæ* in some of the West Indian islands. It may be only a form of *yuccæ*.

(30) *Dactylopius citri*, Risso, syn. ***destructor***, Comstock.

(31) ***Dactylopius adonidum***, Linnæus, syns. ***longispinus***, Targioni-Tozzetti, ***longifilis***, Comstock. For a full account of this and the last, see Berlese, Revista di Patologia Vegetale, 1893.

(32) ***Dactylopius vastator***, Maskell. On *Citrus* in Sandwich Islands. (Tr. N. Z. Inst., XXVII, p. 65.) A letter from Mr. J. Marsden, quoted by Mr. Craw in Pacific Rural Press, December 8, 1894, p. 358, probably refers to the same insect; but it is the restated that Mr. Maskell identified it as *D. albizziæ*, while Doctor Riley said it was *Rhizococcus* (misprinted *Riggococcus*).

(33) ***Icerya purchasi***, Maskell. Too well known as a pest of *Citrus* trees.

(34) *Icerya*, sp. On orange, Tokyo, Japan (Takahashi). Presumably new, but I have only seen immature examples.

(35) ***Coccus diacopeis***, Anderson, is a problematical species found on *Citrus aurantium* (syn. ***sinensis***).

(36) ***Diaspis colvei*** in Spain.

SIMARUBEÆ.

The curious spiny shrub or small tree, *Holacantha emoryi*, Gray, is in Arizona the food plant of *Diaspis toumeyi*, Cockerell. Bentham and Hooker cite the plant as from New Mexico[1] but it does not appear to occur in that Territory. It was described from Mexico.

BURSERACEÆ.

A small tropical order. ***Garuga pinnata*** is in India a food plant of *Tachardia lacca*, Kerr. ***Bursera gummifera*** in Antigua produces *Ceroplastes ceriferus*, Anderson.

MELIACEÆ.

Dysoxylum (syn. ***Dysoxylon***) is a rather large genus of the Malay Archipelago, Australia, New Zealand, and New Caledonia. The New Zealand *D. spectabile*, J. D. Hooker, is cited by Maskell as a food plant of *Aspidiotus dysoxyli*, Maskell, *Mytilaspis* ***pyriformis***, Maskell, and ***Chionaspis dysoxyli***, Maskell.

The so-called China tree, *Melia azedarach*, a native of the Himalayan region, is commonly cultivated in the United States, especially in the arid region. It is almost free from the attacks of insects in this country, but more than once it has been found infested by *Aspidiotus nerii*, Bouché.

AQUIFOLIACEÆ.

A small order, best known by the holly. This shrub has long been known as a food plant of *Lecanium hesperidum*, Linnæus, to which Coquillett, from his Californian experience, adds *L. oleæ*, Bernard, and

[1] Genera Plantarum I, p. 310.

Aspidiotus rapax, Comstock. In Europe, *Aspidiotus hederæ*, Vallot, is recorded from holly. The American ink berry or gall berry (*Ilex glabra* (Linnæus), Gray) is a plant of the same genus as the holly, but its berries are black instead of red. It has been found supporting *Ceroplastes floridensis*, Comstock, and *Rhizococcus quercus*, more properly *Eriococcus quercus*, Comstock.

CELASTRINEÆ.

One genus of this large order, *Euonymus*, has often been noticed as infested by coccids. The European *E. latifolius* is affected by *Chionaspis euonymi*, Comstock, while *E. japonicus*, a native of China and Japan, has been found to support the doubtless exogenetic *Aspidiotus rapax*, Comstock. Maskell records a case of *Diaspis santali*, Maskell, usurping the place of *A. rapax*, Comstock, on *Euonymus*. From cultivated species of the genus, not specifically identified, Coquillett reports *Lecanium oleæ*, Bernard, and *L. hesperidum*, Linnæus. Riley records *Pulvinaria innumerabilis*, Rathvon, and I have cited a *Pulvinaria* believed to be a variety of *P. simulans*, Cockerell.[1] There is, besides, a *Pulvinaria euonymi*, Goureau, in Europe.

Celastrus ceriferus is known as a food plant of *Ceroplastes ceriferus*, Anderson. This plant is not in the Index Kewensis, and the specific name, cited by Signoret, is doubtless erroneous.[2]

RHAMNEÆ.

Two species of *Zizyphus*, in India, afford *Tachardia lacca*, Kerr. *Parlatoria zizyphus*, Lucas, was described from *Z. pinnachristi* (rect. *spinachristi*?). The Californian *Rhamnus croceus* is infested, according to Coquillett, by *Lecanium oleæ*, Bernard, *L. hesperidum*, Linnæus, and *Aspidiotus rapax*, Comstock. *Rhamnus alaternus* of the Mediterranean region supports *Dactylopius alaterni*, Signoret. Signoret reports *Tachardia lacca*, Kerr, from *Rhamnus jujuba*, but the plant intended is doubtless *Zizyphus jujuba*. Mr. Broadway found *Asterolecanium pustulans*, Cockerell, injuring *Z. jujuba* in Grenada. Coquillett records *Lecanium hibernaculorum*, Boisduval, from the Californian *Ceanothus divaricatus*, Nuttall.

AMPELIDACEÆ.

Riley records *Pulvinaria innumerabilis*, Rathvon, from the cultivated *Ampelopsis veitchii*, the more correct name of which is *Vitis inconstans*.

The Coccidæ of the grapevine are as follows:

(1) *Margarodes vitis* (*vitium*, Giard). In Chile.

(2) *Dactylopius vitis*, Niedielski. In Europe, and a species, perhaps the same, in Chile.

[1] Can. Ent., 1865, p. 259.

[2] Signoret. Essai; Maskell, Tr. N. Z. Inst., XXV, p. 216.

(3) *Pulvinaria vitis*, Linnæus. In Europe.

(4) *Pulvinaria innumerabilis*, Rathvon. In America, on both wild and cultivated vines.

(5) *Lecanium oleæ*, Bernard. See Insect Life, 1893, p. 160.

(6) *Lecanium prunosum*, Coquillett. Riley, cited by Coquillett, Insect Life, III, p. 384.

(7) *Lecanium hesperidum*, Linnæus. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 26.

(8) *Lecanium depressum*, Targioni-Tozzetti. Maskell, Tr. N. Z. Inst., XXV, p. 220. Maskell records it as on vine; I infer that he means grapevine.

(9) *Lecanium*, sp. Some forms of *Eulecanium*, not yet sufficiently studied, have been found; Cockerell, Trans. Amer. Ent. Soc., 1893, p. 52; Maskell, Tr. N. Z. Inst., XXIV, p. 22.

(10) *Aspidiotus vitis*, Signoret. On grapes in the Mediterranean region.

(11) *Aspidiotus uvæ*, Comstock. In the United States, and rarely in Jamaica.

(12) *Aspidiotus articulatus*, Morgan. On *Vitis vinifera* in Nevis; Journ. Inst. Jamaica, 1893, p. 255.

(13) *Aspidiotus aurantii*, Maskell. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 15.

(14) *Chionaspis minor*, Maskell. Insect Life, V, p. 246.

(15) *Diaspis amygdali*, Tryon (syn. *lanatus*). Townsend, Journ. Inst. Jamaica, 1893, pp. 283, 378.

(16) *Coccus microgenes*, Anderson, is a problematical species from *Vitis vinifera*.

There should also be added to the *Vitis* coccids a new species, *Chionaspis vitis*, Green, found by Mr. E. E. Green in Ceylon.

SAPINDACEÆ.

A large order, consisting almost entirely of trees. In Europe the horse-chestnut, *Æsculus hippocastanum*, is the food plant of *Aspidiotus hippocastani*, Signoret, *Lecanium æsculi*, Koelar, and *Phenacoccus æsculi*, Signoret. In Palo Alto, California, *Aspidiotus æsculi*, W. G. Johnson, is found on *Æsculus californica*, Nuttall.

The akee, *Cupania* or *Blighia sapida*, is cultivated in Jamaica, where it affords food to *Asterolecanium pustulans*, Cockerell, *Pulvinaria cupaniæ*, Cockerell, *Aspidiotus articulatus*, Morgan, and *A. personatus*, Comstock. Another tree cultivated in Jamaica is the genip, *Melicocca bijuga*, a native of tropical America. On it are found *Ceroplastes floridensis*, Comstock, *Aspidiotus personatus*, Comstock, and *A. articulatus*, Morgan. *Schleichera trijuga* is cited by Watt as a food plant of *Tachardia lacca*, Kerr. Is not this the same as the *Melicocca?* Another food plant of *T. lacca* in India is *Nephelium lit-chi*, Camb., a native of China.

The box elder, *Negundo aceroides*, or more properly *Acer negundo*, is attacked by *Pulvinaria innumerabilis*, Rathvon, *Lecanium* (*Eulecanium*) sp., and *Aspidiotus ancylus*, Putnam. The *Lecanium* is a species similar to *L. quercifex*, Fitch, but it has not been sufficiently studied. The following species of *Acer* are recorded as host plants of coccids, in addition to the box elder:

(1) *Acer campestre*, Linnæus. European. *Acanthococcus* (more properly *Eriococcus*) *aceris*, Signoret.

(2) *Acer pseudoplatanus*, Linnæus. South European and Oriental. *Chionaspis aceris*, Signoret, *Lecanium aceris*, Schrank, and *Phenacoccus aceris*, Signoret, all in Europe.

(3) *Acer saccharinum*, Linnæus (syn. *dasycarpum*), North America. Riley records *Pulvinaria innumerabilis*, Rathvon; Coquillett *Lecanium oleæ*, Bernard, and *L. hesperidum*, Linnæus, these latter in California.

(4) *Acer rubrum*, Linnæus. North America. Mundt (Can. Ent., 1884, p. 240) records *Pulvinaria innumerabilis*, Rathvon; *Mytilaspis pomorum*, Bouché, is cited in Country Gentleman, January 10, 1895, p. 27. Comstock records *Aspidiotus tenebricosus*, Comstock.

(5) *Acer saccharum*, Marshall, syn. *saccharinum*, Wanzenheim. North America. *Pulvinaria innumerabilis*, Rathvon, and *Mytilaspis pomorum*, Bouché, are cited l. c. sub *A. rubrum*.

(6) *Acer pennsylvanicum*, Linnæus. North America. *Mytilaspis pomorum*, Bouché, is mentioned in Country Gentleman, January 10, 1895, p. 27.

In addition to the above, *Aspidiotus ancylus*, Putnam, is a well-known maple species,[1] while Comstock reports *Aspidiotus nerii*, Bouché, and Coquillett, *A. rapax*, Comstock. Mr. W G. Johnson's *A. comstocki* is from sugar maple. From Sycamore, Maskell reports *Mytilaspis pomorum*, Bouché, Riley *Pulvinaria innumerabilis*, Rathvon, and Coquillett, *Lecanium oleæ*, Bernard. It is not certain, however, which of these records really refer to *A. pseudoplatanus*, and which to *Platanus occidentalis*.

Dodonæa is a large genus of trees and shrubs found in Australia for the most part. *D. bursarifolia*, F. Mueller, supports *Pulvinaria dodonææ*, Maskell. The bladder nut, *Staphylea*, is given by Comstock as a food plant of *Aspidiotus ancylus*, Putnam, and *Mytilaspis pomorum*, Bouché. This shrub, placed both by Bentham and Hooker and Gray in Sapindaceæ, appears in the recent check list of the Botanical Club under a distinct order, Staphyleaceæ. At the same time the maples are separated under Aceraceæ, and the horse chestnuts under Hippocastanaceæ, doubtless following Engler and Prantl, which I have not had an opportunity to consult.

ANACARDIACEÆ.

A large order of trees and shrubs. *Rhus succedanea* produces *Ericerus pe-la*. Mundt reports *Pulvinaria innumerabilis*, Rathvon, from *Rhus toxicodendron* (or *radicans*); Riley cites the same insect from sumac. Coquillett cites *Lecanium oleæ*, Bernard, and *L. hesperidum*, Linnæus, from *Rhus integrifolia* in California.

The mastic tree, *Pistacia lentiscus*, Linnæus, of the Mediterranean region, supports *Aspidiotus lentisci*, Signoret. The mango, *Mangifera indica*, Linnæus, is a native of the oriental region, but is now abundant in the western tropics. In the east it is infested by *Lecanium mangiferæ*, Green, and *Tachardia lacca*, Kerr; in the Sandwich Islands, according to Maskell, by *Aspidiotus longispina*, Morgan. At Brisbane, Australia, again on Maskell's authority, there is found upon it *Ceroplastes rubens*, Maskell. In the West Indies, it is a host of *Dactylopius longifilis*, Comstock (more correctly *longispinus*). *Ceroplastes floridensis*, Comstock, *Lecanium mangiferæ*, Green, *L. oleæ*, Bernard, *L.*

[1] Comstock, Rept. Dept. Agric. for 1880; Cockerell, Can. Ent., 1894, p. 191.

hesperidum, Linnæus, *Vinsonia stellifera*, Westwood, *Aspidiotus mangiferæ*, Cockerell, *A. destructor*, Signoret (syn. *fallax*, Cockerell), *A. articulatus*, Morgan, and *A. personatus*, Comstock. Thus, in all, thirteen coccids are recorded from the mango.

Aspidiotus articulatus, Morgan, and *A. personatus*, Comstock, are found on the West Indian *Anacardium occidentale*, Linnæus. *Schinus molle*, in Mexico, supports the beautiful green *Lecanium schini*, Cockerell, but in California Coquillett found on it *L. oleæ*, Bernard, and *L. hesperidum* Linnæus. *Ceroplastes albolineatus*, Cockerell, is recorded from *Schinus*.

Aspidiotus nerii, Bouché, is reported by Maskell, exogenetically of course, on the New Zealand *Corynocarpus laevigata*.

The Mexican *Llarcia axinus*, Llave, is found on *Spondias myrobalanus*. The Otaheite apple, *Spondias dulcis*, supports *Lecanium mangiferæ*, Green, in Jamaica.

LEGUMINOSÆ.

Poliaspis exocarpi, Maskell, occurs on *Oxylobium trilobatum*.[1] *Daviesia* is a large Australian genus; on *D. corymbosa* are found *Chionaspis nitida*, Maskell, and *Pulvinaria tecta*, Maskell. *Dillwynia* has about a dozen species, exclusively Australian; on *D. juniperina*, Loddiges, occurs *Lecanium pingue*, Maskell; on an undetermined species, *Poliaspis exocarpi*, Maskell. *Bossiæa* is another Australian genus; Maskell cites *Aspidiotus bossiæ*, Maskell (should be *bossiæa*), from *B. procumbens*. The specific name of this plant is not in the Index Kewensis.

In Europe *Lecanium genistæ* is found on *Genista anglica*, and *Aspidiotus genistæ*, Signoret, on *Cytisus scoparius* (syn. *Genista scoparia*). Newstead[2] records *Mytilaspis pomorum*, Bouché, on *Cytisus scoparius* in Guernsey, and on *C. nubigenus* on the Peak of Teneriffe, at 7,000–8,000 feet. *Lecanium distinguendum*, Douglas, occurs on *C. scoparius* in Guernsey, as reported by Mr. Luff. Maskell records *Icerya purchasi*, Maskell, exogenetically upon gorse, *Ulex*. *Eriococcus insignis*, Newstead, is found on *Ulex*.[3] Douglas has described a *Mytilaspis ulicis*, but it is apparently a variety of *M. pomorum*.

Aspidiotus nerii, Bouché, was noticed by Comstock exogenetically upon clover, *Trifolium*. There are two clover mealy bugs, *Dactylopius areæ*, Maskell, and *D. trifolii*, Forbes, both at roots of red clover, *Trifolium pratense*, but on opposite sides of the world.[4]

Dalea or *Parosela formosa* is in the Mesilla Valley, New Mexico, the food plant of *Ceroplastodes daleæ*, Cockerell.

According to Comstock, *Mytilaspis pomorum*, Bouché, has been found upon *Amorpha*. The problematical *Coccus microgenes*, Anderson, was

[1] Maskell, Tr. N. Z. Inst., XXVII, p. 52.
[2] Ent. Mo. Mag., June, 1893, p. 138.
[3] Ent. Mo. Mag., 1891, p. 165.
[4] Insect Life, VII, p. 171; Tr. N. Z. Inst., XXV, p. 231.

recorded from *Galega prostrata*, but the plant is now called *Tephrosia purpurea*.

The cultivated locust, *Robinia pseudacacia*, is quite subject to coccid attacks; the species being, in Europe, *Dactylopius robiniæ*, Signoret, and *Lecanium robiniarum*, Douglas; in America, *Pulvinaria innumerabilis*, Rathvon, *Lecanium robiniarum*, Douglas, *L. hesperidum*, Linnæus, *Mytilaspis pomorum*, Bouché, *Aspidiotus rapax*, Comstock, and *A. juglansregiæ*, Comstock.

In New Mexico the native *Robinia neomexicana* is infested by *Lecanium quadrifasciatum*, Cockerell. *Robinia mitis* is recorded as supporting *Coccus erion*, Anderson, in India.

Lecanium wistariæ, Signoret, was found by Signoret on *Wistaria chinensis* (syn. *sinensis*). This was in France, but the plant is a native of China.

Some species of *Sesbania* is supposed to be the food plant of *Tachardia fulgens*, Cockerell, in Arizona. *Asterolecanium fimbriatum*, Fonscolombe, occurs, in Europe, on *Coronilla glauca*, a native of the Mediterranean region. *Ougeinia dalbergioides*, Bentham, the only species of its genus, is in India a food plant of *Tachardia lacca*, Kerr. *Clitoria ternatea* in the West Indies is sometimes infested by *Orthezia insignis*, Douglas.

Kennedya rubicunda, Ventenat, a native of Australia, supports *Aspidiotus kennedyæ*, Boisduval; and in California, according to Coquillett, *A. aurantii*, Maskell.

In the West Indies, *Aspidiotus personatus*, Comstock, *A. articulatus*, Morgan, and *Ceroplastes floridensis*, Comstock, occur upon *Erythrina* in cultivation. In India, *Erythrina indica*, Lambert, produces *Tachardia lacca*, Kerr, and *E. corallodendron*, Linnæus, the problematical *Coccus erion*, Anderson. The first of these trees is a native of tropical Asia, but the other originated in the Western Hemisphere.

Butea frondoxa, Roxburgh, and another species of the genus, produce *Tachardia lacca*, Kerr. The East Indian pigeon pea, *Cajanus indicus*, is decidedly subject to the attacks of coccids—in India *Eriochiton cajani*, Maskell, in the West Indies *Asterolecanium pustulans*, Cockerell, and *Lecanium longulum*, Douglas. *Tachardia lacca*, Kerr, is found, in India, on two species of *Dalbergia* and *Pterocarpus marsupium*. *Aspidiotus sophoræ*, Maskell, occurs on *Sophora tetraptera*. The honey locust, *Gleditschia triacanthos*, is given by Gillette and Baker as a food plant of *Pulvinaria innumerabilis*, Rathvon, and Johnson records from it his *Aspidiotus forbesi*. *Aspidiotus ancylus*, Putnam, has been found on the water locust, *G. monosperma*. On *Cassia fistula*, a native of tropical Asia, are found, in Jamaica, *Aspidiotus articulatus*, Morgan, and *A. personatus*, Comstock. *Ceratonia siliqua*, the only species of its genus, nourishes *Aspidiotus ceratoniæ*, Signoret, and *Dactylopius ceratoniæ*, Signoret, in Europe, and *Tachardia lacca*, Kerr, in India. *Amherstia nobilis*, the only species of its genus, and a native of Bur-

mah, is, in the West Indies, quite liable to be infested by *Icerya rosæ*, Riley and Howard.

Prosopis juliflora is infested, in Jamaica, by *Icerya rosæ*, Riley and Howard, and *Dactylopius virgatus*, Cockerell. Its variety *glandulosa* produces, in Arizona, *Aspidiotus prosopidis*, Cockerell, *Lecanium mirabile*, Cockerell, and *Lecaniodiaspis* (*Prosopophora*) *prosopidis*, Maskell. The same, in the Mesilla Valley of New Mexico, nourishes *Icerya rileyi*, Cockerell. The curious *Lecanium mirabile*, Cockerell, was supposed to be confined to Arizona, but on October 12, 1895, Professor C. H. T. Townsend found it on mesquite in Tularosa, New Mexico, where it is much attacked by a lepidopterous larva. Coquillett records *Icerya purchasi*, Maskell, from *Prosopis*, thus making the third *Icerya* found on this genus. *Tachardia lacca*, Kerr, is found on the Indian *Prosopis spicigera*, Linnæus, and also on *Dichrostachys cinerea*, Wight and Arnot. The latter plant should, by the rule of priority, be called *Caillica cinerea*, the genus *Caillica* having one year priority, according to the dates given in Index Kewensis. There appears, however, to be some confusion, as *Dichrostachys* is in one place credited to Wight and Arnot, 1834, in another to De Candolle.

Tachardia lacca, Kerr, according to Signoret, occurs on *Mimosa cinerea*, and *M. corinda*. The former of these is a Brazilian species. The latter name is probably incorrect, as it is not in the Index Kewensis. In Mexico, *Lecanium imbricatum*, Cockerell, is found on *Mimosa*.

The Coccidæ found on *Acacia* are numerous, namely:

(1) *Carlostoma immane*, Maskell. On the Australian *A. aneura*, F. Mueller. Maskell, Tr. N. Z. Inst., XXIV, p. 50.

(2) *Icerya purchasi*, Maskell. On *Acacia*. Comstock, 2d Cornell Rept., p. 139.

(3) *Eriococcus multispinus*, Maskell, var. *lævigatus*. On the Australian *A. armata*, Robert Brown. Maskell, Tr. N. Z. Inst., XXIII, p. 21.

(4) *Rhizococcus grandis*, Maskell. On the roots of the Australian *A. longifolia*, Willdenow. Maskell, Tr. N. Z. Inst., XXIV, p. 30.

(5) *R. grandis* var. *spinosior*, Maskell. On the Australian *A. implexa*, Bentham. Maskell, Tr. N. Z. Inst., XXV, p. 230.

(6) *Dactylopius globosus*, Maskell. On the Australian *A. decurrens*, Willdenow and *A. armata*. Maskell, Tr. N. Z. Inst., XXIV, p. 35.

(7) *Dactylopius acaciæ*, Maskell. On the Australian *A. lincaris*, Sims. Maskell, Tr. N. Z. Inst., XXIV, p. 33. *Acacia lophantha*, another food plant of this species, is properly an *Albizzia*.

(8) *Phenacoccus nivalis*, Maskell. On *Acacia* sp. Maskell, Tr. N. Z. Inst., XXV, p. 234.

(9) *Sphærococcus acaciæ*, Maskell. On *Acacia* sp. Maskell, Tr. N. Z. Inst., XXV, p. 237.

(10) *Lecaniodiaspis* (*Prosopophora*) *acaciæ*, Maskell. On the Australian *A. calamifolia*, Sweet. Maskell, Tr. N. Z. Inst., XXV, p. 226.

(11) *Asterolecanium* (*Planchonia*) *centruosum*, Maskell. On *Acacia* sp. Maskell, Tr. N. Z. Inst., XXVII, p. 63.

(12) *Kermes acaciæ*, Maskell. On *Acacia* sp. Maskell, Tr. N. Z. Inst., XXVI, p. 83.

(13) *Tachardia lacca*, Kerr. On the Indian *A. catechu*, Willdenow, and another species. Watt Dict. Econ. Prod. India, II, p. 410.

(14) *Tachardia larreæ*, Comstock. On the North American *A. greggi*, A. Gray.

(15) *Tachardia acaciæ*, Maskell. On *Acacia* sp. Maskell, Tr. N. Z. Inst., XXIV, p. 56.

(16) *Ceroplastodes acaciæ*, Cockerell. On the North American *A. constricta*, Bentham. Cockerell, Psyche Supp., 1895, p. 2.

(17) *Ceroplastodes niveus*, Cockerell. Believed to occur on *Acacia*, but the species not determined.
(18) *Ceroplastes mimosæ*, Signoret. On *Mimosa nilotica*, the correct name of which is *Acacia arabica*, Willdenow. It is a native of Africa and Asia.
(19) *Inglisia vitrea*, Cockerell. On *Acacia* sp. Cockerell, Journ. Trinidad Club, 1894, p. 308.
(20) *Lecanium longulum*, Douglas. On *Acacia* sp. Maskell, Tr. N. Z. Inst., XXV, p. 221.
(21) *Lecanium scrobiculatum*, Maskell. On *Acacia* sp. Maskell, Tr. N. Z. Inst., XXV, p. 222.
(22) *Lecanium baccatum*, Maskell. On the Australian *A. armata*, *A. calamifolia*, and *A. longifolia*. Maskell, Tr. N. Z. Inst., XXIV, p. 21.
(23) *Pulvinaria tecta*, Maskell. On *Acacia* sp. Maskell, Tr. N. Z. Inst., XXVI, p. 80.
(24) *Fiorinia rubra*, Maskell. On *Acacia* sp. Maskell, Tr. N. Z. Inst., XXVI, p. 72.
(25) *Fiorinia acaciæ*, Maskell. On the Australian *A. pycnantha*, Bentham. Maskell, Tr. N. Z. Inst., XXIV, p. 16.
(26) *Mytilaspis convexa*, Maskell. On *Acacia* sp. Maskell, Tr. N. Z. Inst., XXVI, p. 70.
(27) *Mytilaspis grisea*, Maskell. On *Acacia* sp. Maskell, Tr. N. Z. Inst., XXII, p. 134.
(28) *Mytilaspis spinifera*, Maskell. On the Australian *A. pendula*, A. Cunningham. Maskell, Tr. N. Z. Inst., XXVI, p. 70.
(29) *Aulacaspis boisduvalii*, Maskell. On wattle. Maskell, Scale Ins. N. Z., p. 114.
(30) *Diaspis santali*, Maskell. On *Acacia*. Maskell, Tr. N. Z. Inst., XXII, p. 135.
(31) *Aspidiotus aurantii*, Maskell. On *Acacia*. Coquillett, Bull. 26, Div. Ent. U. S. Dept. Agric., p. 15.
(32) *Aspidiotus unilobis*, Maskell. On *Acacia* sp., called "tea tree." Maskell, Tr. N. Z. Inst., XXVII, p. 40.
(33) *Aspidiotus ceratus*, Maskell. On the Australian *A. stenophylla*, A. Cunningham. Maskell, Tr. N. Z. Inst., XXVII, p. 39.
(34) *Aspidiotus epidendri*, Maskell. On wattle. Maskell, Scale Ins. N. Z., p. 114.
(35) *Aspidiotus nerii*, Bouché. On *Acacia*. Comstock, 2d Cornell Rept., p. 139.
(36) *Aspidiotus rapax*, Comstock. On *Acacia*. Comstock, 2d Cornell Rept., p. 139; also as *A. camelliæ*, Maskell, Tr. N. Z. Inst., XXII, p. 135.
(37) *Aspidiotus fodiens*, Maskell. On *Acacia* sp. Maskell, Tr. N. Z. Inst., XXIV, p. 10.
(38) *Aspidiotus acaciæ*, Morgan. On *Acacia pycnantha* in Tasmania.
(39) *Aspidiotus acaciæ*, Morgan, var. *propinquus*, Maskell. On *Acacia* sp. Maskell, Tr. N. Z. Inst., XXV, p. 205.

On the Australian *Albizzia lophantha*, Bentham, are found *Dactylopius albiziæ*, Maskell, and *D. acaciæ*, Maskell. *Tachardia lacca*, Kerr, occurs on the Indian *A. lucida*, Bentham, also on *Pithecolobium dulce*, Bentham, a native of tropical America.

ROSACEÆ.

In Jamaica, *Tachardia gemmifera*, Cockerell, is found on *Chrysobalanus icaco*. The peach, *Prunus* or *Amygdalus persica*, is especially attacked by *Diaspis amygdali*, Tryon (syn. *lanatus*), but also by *Lecanium pruinosum*, Coquillett, *L. persicæ*, Fabricius, *L. rotundum*, Signoret, *L. rugosum*, Signoret, *L. oleæ*, Bernard (see Olliff), *Pulvinaria persicæ*, Newstead, *Diaspis leperii* Signoret, *D. patelliformis*, Sasaki, *D. pentagona*, Targioni-Tozzetti, *Mytilaspis pomorum*, Bouché (see Maskell), *Aspidiotus ancylus*, Putnam, *A. ostreæformis*, Comstock, *A. perniciosus*, Comstock, *A. juglans-regiæ*, Comstock, *A. forbesi*, Johnson, and *Aonidia*

fusca, Maskell.[1] The *A. ostreæformis* was on peach from Isleworth, England, sent by Mr. George Manville Fenn. From the almond, *P.* or *A. communis*, Coquillett records *Lecanium oleæ*, Bernard, and *Aspidiotus perniciosus*, Comstock.

The coccids recorded from the species of *Prunus* proper are as follows:

(A) From the apricot, *P. armeniaca.*

(1) *Lecanium pruinosum*, Coquillett. Coquillett, Insect Life, III, p. 383. It has been questioned whether *L. armeniacum* is a distinct species from this.

(2) *L. hesperidum* Linnæus. Coquillett, Bull. 26, Div. Ent. U. S. Dept. Agric., p. 26.

(3) *L. oleæ*, Bernard. Coquillett, Bull. 26, Div. Ent. U. S. Dept. Agric., p. 28; also Comstock, 2d Cornell Rept., p. 139; Olliff, Agric. Gaz. N. S. W., November, 1891, p. 668.

(4) *Mytilaspis pomorum*, Bouché. Maskell, Scale Ins. N. Z., p. 111.

(5) *Aspidiotus juglans-regiæ*, Comstock, var. *albus*, Cockerell. Cockerell, Southwestern Farm and Orchard, August, 1894, p. 6; Insect Life, VII, p. 211; Can. Ent., 1895, p. 260.

(B) From the garden plum, *P. domestica.*

(1) *Phenacoccus mespili*, Geoffrey. Signoret, Essai.

(2) *Lecanium juglandis*, Bouché. Cockerell, Ent., 1894, pp. 332–336. *L. variegatum*, also on plum, appears to be the same.

(3) *L. pruinosum*, Coquillett. On prune. Coquillett, Insect Life, III, p. 384.

(4) *L. oleæ*, Bernard. Comstock, 2d Cornell Rept., p. 140.

(5) *L.* sp., perhaps *rosarum*, Snellen. Cockerell, Trans. Amer. Ent. Soc., 1893, p. 54.

(6) *Mytilaspis pomorum* Bouché. Maskell, Scale Ins. N. Z., p. 113; see also Country Gentleman, January 10, 1895, p. 27.

(7) *Diaspis santali*, Maskell. Maskell, Scale Ins. N. Z., p. 113.

(8) *Aspidiotus aurantii*, Maskell. Maskell, Tr. N. Z. Inst., XXV, p. 206.

(9) *A. nerii*, Bouché. Comstock, 2d Cornell Rept., p. 140.

(10) *A. perniciosus*, Comstock. Comstock, 2d Cornell Rept., p. 140.

(11) *A. ancylus*, Putnam. On plum in Santa Fe, New Mexico.

(12) *A. juglans-regiæ*, Comstock. On prune. Cockerell, Can. Ent., 1895, p. 260; also var. *pruni*, Cockerell, Can. Ent., 1894, p. 131.

(13) *A. howardi*, Cockerell. Cockerell, Can. Ent., 1895, p. 16. There recorded from Colorado; since found in Albuquerque, New Mexico.

(14) *A. piricola*, Del Guercio. Cockerell, Can. Ent., 1895, p. 260.

(15) *A. forbesi*, Johnson. W. G. Johnson, Ent. News, 1896, p. 151.

(C) From the blackthorn, *P. spinosa.*

(1) *Lecanium prunastri*, Fonscolombe. Signoret, Essai.

(D) From the bird cherry, *P. padus.*

(1) *Coccus padi*, Schrank. A species not now recognized.

(E) From the garden cherries, *P. cerasus*, etc.

(1) *Lecanium cerasifer*, Fitch. Comstock, 2d Cornell Rept., p. 139; Signoret, Essai. On black cherry.

(2) *L. pruinosum*, Coquillett. Coquillett, Insect Life, III, p. 384.

(3) *Aspidiotus nerii*, Bouché. Comstock, 2d Cornell Rept., p. 139.

(4) *A. juglans-regiæ*, Comstock. Comstock, 2d Cornell Rept., p. 139.

(5) *A. ancylus*, Putnam, var. Cockerell, Can. Ent., 1895, p. 261. Mr. W. G. Johnson, having given this form careful study, is assured that it is not true *ancylus*, but a new species closely allied, which he will describe, calling it *A. forbesi.*

(6) *Chionaspis furfurus*, Fitch. Recorded as *Aspidiotus cerasi.*

[1] For a discussion of the resemblances between *A. perniciosus* and *Aon. fusca*, see Maskell, Can. Ent., 1896, p. 14.

(7) *Diaspis amygdali*, Putnam. On dwarf cherry. Cockerell, Can. Ent., 1895, p. 260.
(8) *Aspidiotus* (*Diaspidiotus*) *patarinus*, Berlese. On the bark.

(F) From the wild red cherry, *P. pennsylvanica.*

(1) *Mytilaspis pomorum*, Bouché. Country Gentleman, January 10, 1895, p. 27.

(G) From the cherry laurel, *P. laurocerasus.*

(1) *Lecanium pruinosum*, Coquillett. Coquillett, Insect Life, III, p. 384.
(2) *L. elongatum*, Signoret. Signoret, Essai. In France.
(3) *L. oleæ*, Bernard. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 28.
(4) *Aspidiotus rapax*, Comstock. Coquillett, Bull. 26, Div. Ent., U. S. Dept, Agric., p. 25.

(H) From the Japanese *P. paniculata*, syn. *pseudocerasus.*

(1) *Diaspis patelliformis*, Sasaki. Sasaki, Bull. Imperial Univ., Coll. of Agric., Tokyo, II, No. 3.

Maskell describes *Chionaspis prunicola*, found on Japanese plum in the Sandwich Islands.[1] Comstock reports *Ceroplastes floridensis*, Comstock, from Japan plum (*Biotrites*—this generic name is not in Index Kewensis or Genera Plantarum). *Aspidiotus juglansregiæ*, Comstock, is also recorded from Japan plum.[2] Professor L. H. Bailey says: "The so-called Japan plum of the extreme south is the loquat." From *Spiræa* are recorded two exogenetic forms, *Icerya purchasi*, Maskell,[3] and *Lecanium*, apparently *persicæ*, Fabricius.[4]

The following occur on *Rubus:*

(A) On the raspberries and blackberries.

(1) *Lecanium fitchii*, Signoret. On wild and cultivated blackberry. Insect Life, VII, p. 30; Can. Ent., 1895, p. 255. Signoret cites it as on *R. fruticosus.*
(2) *Mytilaspis pomorum*, Bouché. Comstock, 2d Cornell Rept., p. 139. On raspberry.
(3) *Aulacaspis rosæ*, Bouché. Comstock, 2d Cornell Rept., p. 139. On raspberry and blackberry.
(4) *Icerya purchasi*, Maskell. Coquillett, Rept. Dept. Agric. for 1888, p. 84. A few on raspberry.

The above have been noticed in America; the two following in Europe:

(5) *Lecanium rubi*, Schrank. Douglas, Ent. Mo. Mag., 1892, p. 105.
(6) *Tetrura rubi*, Lichtenstein. Lichtenstein, Bull. Soc. Ent., France, 1882. A Dactylopiine form, on *R. discolor.*

(B) On the bush lawyer, *Rubus australis*, in New Zealand.

(1) *Eriococcus multispinus*, Maskell. Maskell, Scale Ins. N. Z., p. 113.
(2) *Dactylopius glaucus*, Maskell. Maskell, Scale Ins. N. Z., p. 113.
(3) *Ctenochiton viridis*, Maskell. Maskell, Scale Ins. N. Z., p, 113.
(4) *C. perforatus*, Maskell. Maskell, Scale Ins. N. Z., p, 113.
(5) *Chionaspis dubia*, Maskell. Maskell, Scale Ins. N Z., p. 113.

On species of *Rosa* the following have been found:

(1) *Icerya rosæ*, Riley and Howard. Riley and Howard, Insect Life; also Cockerell, Journ. Inst. Jamaica, 1892, p. 97.
(2) *I. purchasi*, Maskell. Maskell, Scale Ins. N. Z. p. 113; Comstock, 2d Cornell Rept., p. 140.
(3) *I. montserratensis*, Riley and Howard. At Colon. Insect Life, 1894, p. 327.

[1] Tr. N. Z. Inst., XXVII, p. 49.
[2] Cockerell, Can. Ent., 1894, p. 132.
[3] Coquillett, Rept. Dept. Agric. for 1888.
[4] Cockerell, Trans. Amer. Ent. Soc., 1893, p. 52.

(4) *Pulvinaria innumerabilis*, Rathvon. Riley, Rept. Dept. Agric. for 1884.
(5) *Lecanium hesperidum*, Linnæus. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 26; Cockerell, Ann. Mag. Nat. Hist., July, 1893, p. 52.
(6) *L. quercitronis*, Fitch, var. Cockerell, Can. Ent., 1895, p. 255.
(7) *L. pruinosum*, Coquillett. Cockerell. Can. Ent., 1895, p. 255.
(8) *L. rosarum*. Snellen. On *R. centifolia*. Cockerell, Trans. Amer. Ent. Soc., 1893, p. 54.
(9) *L. oleæ*, Bernard. Comstock, 2d Cornell Rept., p. 140.
(9*a*) *L. capreæ*, Linnæus. Douglas, Ent. Mo. Mag., 1892, p. 279. England.
(10) *Aulacaspis rosæ*, Bouché. On *R. canina*. Douglas, Ent. Mo. Mag., 1887, p. 24.
(11) *Aspidiotus articulatus*, Morgan. Cockerell, Ann. Mag. Nat. Hist., July, 1893, p. 48.
(12) *A. ficus*, Ashmead. Cockerell, Ann. Mag. Nat. Hist., July, 1893, p. 48; also Journ. Inst. Jamaica, 1892, p. 54.
(13) *A. dictyospermi*, Morgan, var. *jamaicensis*, Cockerell. Cockerell, Can. Ent., 1894, p. 128.
(14) *A. aurantii*, Maskell. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 15.
(15) *A. perniciosus*, Comstock. Cockerell, Amer. Nat., 1895, p. 726.
(16) *A. personatus*, Comstock. Cockerell, Amer. Nat., 1895, p. 726.

From *Pyrus* or *Mespilus germanica* are recorded *Phenacoccus mespili*, Geoffrey, by Signoret, and *Aspidiotus targionii*, by Del Guercio. The last is really a *Parlatoria*.

From the quince, *Pyrus cydonia* or *Cydonia vulgaris* (properly *Cydonia cydonia*, if the latter generic name be maintained) come *Ceroplastes cirripediformis*, Comstock, *C. floridensis*, Comstock, *Aspidiotus cydoniæ*, Comstock, *A. rapax*, Comstock, and *A. perniciosus*, Comstock. Gillette and Baker record *A. rapax* (as *camelliæ*) from the Japanese quince, *C. japonica*.

On *Pyrus* proper are:

(A) On the apple, *P. malus*.
(1) *Dactylopius glaucus*, Maskell. Maskell, Scale Ins., N. Z., p. 111.
(2) *Lecanium pyri*, Schrank. Cockerell, Can. Ent., 1894, p. 35.
(3) *L. pruinosum*, Coquillett. Coquillett, Insect Life, III, p. 384.
(4) *L. oleæ*, Bernard. Comstock, 2d Cornell Rept., p. 139.
(5) *Parlatoria proteus*, Curtis. Maskell, Tr. N. Z. Inst., XXV, p. 213.
(6) *Mytilaspis pomorum*, Bouché. Signoret, Essai, and most authors.
(7) *Diaspis ostreæformis*, Comstock. Comstock, 2d Cornell Rept., p. 139.
(8) *Chionaspis furfurus*, Fitch. Comstock, 2d Cornell Rept., p. 139.
(9) *Aspidiotus perniciosus*, Comstock. Comstock, 2d Cornell Rept., p. 139.
(10) *A. rapax*, Comstock. Olliff, Ent. Notes, Dept. Agric. N. S. W., September, 1892, p. 2.
(11) *A. juglans-regiæ*, Comstock, var. *albus*, Cockerell. Cockerell, Can. Ent., 1895, p. 260.
(12) *A. forbesi*, Johnson. W. G. Johnson, Ent. News, 1896, p. 151.

(B) On the pear, *P. communis*.
(1) *Pulvinaria pyri*. Signoret, Essai; Comstock, 2d Cornell Rept., p. 140.
(2) *Lecanium pyri*, Schrank. Comstock, 2d Cornell Rept., p. 140.
(3) *L. pruinosum*, Coquillett. Coquillett, Insect Life, III, p. 384.
(4) *L. hibernaculorum*, Boisduval. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 27.
(5) *L. oleæ*, Bernard. Comstock, 2d Cornell Rept., p. 140.
(6) *L.* sp. Cockerell, Ann. Mag. Nat. Hist., 1893, p. 406. In New Mexico.
(7) *Mytilaspis pomorum*, Bouché. Country Gentleman, January 10, 1895, p. 27; Maskell, Scale Ins., N. Z., p. 113.

(8) *Diaspis santali*, Maskell. Maskell, Scale Ins., N. Z., 113.
(9) *D. ostreæformis*, Comstock. Comstock 2d Cornell Rept, p. 140; Colvée, An. Soc. Ent. France, 1881, Bull., p. lii, described a form as *D. pyri*.
(10) *Chionaspis furfurus*, Fitch. Comstock, 2d Cornell Rept., p, 140; Colvée, An. Soc. Ent. France, 1881, Bull., p. lii, described a form as *D. pyri*.
(11) *Aspidiotus aurantii*, Maskell. Maskell, Tr. N. Z. Inst., XXV, p. 206; Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric.
(12) *A. perniciosus*, Comstock. Comstock, 2d Rept., p. 140; Olliff, Ent. Notes, Dept. Agric. N. S. W., September, 1892, p. 1.
(13) *A. juglans-regiæ*, Comstock. Comstock, 2d Rept., p. 140.
(14) *A. juglans-regiæ*, Comstock var. *albus*, Cockerell. Cockerell, Can. Ent., 1894, p. 132; Insect Life, VII, p. 211.
(15) *A. rapax*, Comstock. Olliff, Ent. Notes, Dept. Agric. N. S. W., September, 1892, p. 1; Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric.
(16) *A. ancylus*, Putnam. Gillette and Baker, Hemip. Colo., p. 128.
(17). *A. forbesi*, Johnson. W. G. Johnson, Ent. News, 1896, p. 151.

From the hawthorn, *Cratægus oxyacantha*, are recorded *Mytilaspis pomorum*, Bouché, *Aspidiotus oxyacanthæ*, Signoret, *Pulvinaria oxyacanthæ*, Linnæus, *Lecanium bituberculatum*, Signoret, *L. genevense*, Targioni-Tozzetti, and the problematical *L. vulgare*, Forster.

On species of *Photinia* are found:

(A) On *P.* or *Heteromeles arbutifolia*, a Californian shrub, *Lecanium oleæ*, Bernard, *L. hesperidum*, Linnæus, and *L. hibernaculorum*, Boisduval. (Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric.) All are, of course, exogenetic.
(B) On *P.* or *Eriobotrya japonica*, the loquat of Japan, *Ceroplastes vinsonii*, Signoret (Signoret, Essai), *Lecanium hesperidum*, Linnæus (Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 26), *Aspidiotus rapax*, Comstock (Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 25). One or two other species, recorded from "Japan plum" in the Southern United States, should perhaps be added.

On *Cotoneaster microphylla*, a native of the Himalayan region, Maskell found in New Zealand *Mytilaspis pomorum*, Bouché. On *Amelanchier canadensis* is also found *M. pomorum*.[1]

SAXIFRAGACEÆ.

Signoret records *Lecanium testudo*, Curtis (= *oleæ* var.), from *Brexia madagascariensis* (syn. *spinosa*), a native of Madagascar. He also records *L. hibernaculorum*, Boisduval, from *Brexia*. The genus *Carpodetus* is confined to New Zealand, with one species only, *C. serratus*. On it are found *Aspidiotus carpodeti*, Maskell, and *Diaspis santali*, Maskell. The Australian *Callicoma serratifolia* is attacked by the exogenetic *Aspidiotus rapax*, Comstock.[2]

The following occur on *Ribes:*

(A) On the gooseberry, *R. grossularia*.
(1) *Dactylopius arecæ*, Maskell. On the roots. Maskell, Tr. N. Z. Inst., XXV, p. 231.
(2) *Lecanium rosarum*, Snellen. Maskell, Tr. N. Z. Inst., XXIV, p. 22.
(3) *L. ribis*, Fitch. Maskell, Tr. N. Z. Inst., XXIV, p. 22; XXIII, p. 17.
(4) *Fiorinia grossulariæ*, Maskell. Maskell, scale Inst. N. Z., p. 112.

[1] Country Gentleman, January 10, 1895, p, 27.
[2] Olliff, Ent. Notes, Dept. Agric. N. S. W., September, 1892, p. 2.

(B) On the wild gooseberry, presumably *R. cynosbati*.

(1) *Lecanium cynosbati*, Fitch. Comstock, 2d Cornell Rept., p. 139. Signoret cites this from *R. sylvestris*, which, however, is a variety of the European *R. rubrum*, the coccid being American.

(C) On the wild gooseberry, *R. hirtellum*=*oxyacanthoides*.

(1) *Mytilaspis pomorum*, Bouché. Country Gentleman, January 10, 1895, p. 27.

(D) On the mountain currant, *R. alpinum*, in cultivation in America.

(1) *Mytilaspis pomorum*, Bouché. Comstock, 2d Cornell Rept., p. 139.

(E) On the garden currants, *R. rubrum* and *nigrum*.

(1) *Pulvinaria innumerabilis*, Rathvon. Riley, Rept. Dept. Agric. for 1884.

(2) *P. ribesiæ*, Signoret. On red currant. Ormerod, Man. Inj. Insects, p. 306.

(3) *Lecanium ribis*, Fitch. On both black and red currants. Maskell, Tr. N. Z. Inst., XXIII, p. 17; Comstock, 2d Cornell Rept., p. 139; Cockerell, Trans. Amer. Ent., 1893, p. 54.

(4) *Mytilaspis pomorum*, Bouché. Comstock, 2d Cornell Rept., p. 139; Country Gentleman, January 10, 1895, p. 27.

(5) *Aspidiotus nerii*, Bouché. Comstock, 2d Cornell Rept., p. 139; Country Gentlemen, January 10, 1895, p. 27.

(6) *A. ancylus*, Putnam. On black currant. Cockerell, Amer. Nat., 1895, p. 731.

(7) *A. forbesi*, Johnson. W. G. Johnson, Ent. News, 1896, p. 151.

CRASSULACEÆ.

Bryophyllum calycinum has run wild extensively in Jamaica, and is there attacked by *Diaspis amygdali*, Tryon. *Coccus halophilus*, Hardy, which is doubtless really a *Ripersia*, was found on *Sedum roseum* (syn. *Rhodiola rosea*).

RHIZOPHORACEÆ.

A comparatively small order of tropical trees and shrubs. *Ctenochiton rhizophoræ*, Maskell, occurs on *Rhizophora mangle*, the mangrove, in Queensland.[1]

COMBRETACEÆ.

A rather large tropical order of trees and shrubs. In the West Indies there are found on *Terminalia catappa* several coccids, namely, *Lecanium terminaliæ*, Cockerell, *L. oleæ*, Bernard, *L. begoniæ*, Douglas, and *Aspidiotus destructor*, Signoret, var. *fallax*, Cockerell.[2] Watt cites *Tachardia lacca*, Kerr, from *Terminalia tomentosa*. *Ceroplastes ceriferus*, Anderson, occurs on *T. arjuna*.[3]

MYRTACEÆ.

A very large order. On *Kunzea* is found *Eriococcus araucariæ* var. *minor*, Maskell.[4]

On the Australasian genus *Leptospermum* are numerous coccids, as follows:

(A) On *Leptospermum*, species not identified.

(1) *Fiorinia camelliæ*, Comstock. Maskell, Tr. N. Z. Inst., XXV, p. 212.

[1] Maskell, Tr. N. Z. Inst., XXVII, p. 55.

[2] Cockerell, Journ. Inst. Jamaica, 1893, p. 255; Trans. Amer. Ent. Soc., 1893, p. 52; Insect Life, VI, p. 103.

[3] Spon's Encycl., II, p. 2045.

[4] Maskell, Tr. N. Z. Inst., XXVII, p. 64.

(B) On the Australian *L. lævigatum*, F. Mueller.

(1) *Icerya koebelei*, Maskell. Maskell, Tr. N. Z. Inst., XXV, p. 246.
(2) *Eriococcus leptospermi*, Maskell. Maskell, Tr. N. Z. Inst., XXIII, p. 23.
(3) *Sphærococcus leptospermi*, Maskell. Maskell, Tr. N. Z. Inst., XXVII, p. 68.
(4) *Tachardia melaleucæ*, Maskell. Maskell, Tr. N. Z. Inst., XXVII, p. 31.
(5) *Ripersia leptospermi*, Maskell. Maskell, Tr. N. Z. Inst., XXVII, p. 23.

(C) On the New Zealand *L. scoparium*, Forster.

(1) *Chionaspis dubia*, Maskell, var. *minor*. Maskell, Tr. N. Z. Inst., XXVII, p. 9.
(2) *Mytilaspis intermedia*, Maskell. Maskell, Tr. N. Z. Inst., XXIII, p. 7.
(3) *M. leptospermi*, Maskell. Maskell, Scale Ins. N. Z., p. 112.
(4) *Asterolecanium* (*Planchonia*) *epacridis*, Maskell. Maskell, Scale Ins. N. Z., p. 112.
(5) *Cælostoma wairoense*, Maskell. Maskell, Scale Ins. N. Z., p. 112.
(6) *Ctenochiton flavus*, Maskell. Maskell, Scale Ins. N. Z., p. 112.
(7) *Inglisia leptospermi*, Maskell. Maskell, Scale Ins. N. Z., p. 112.
(8) *I. ornata*, Maskell. Maskell, Scale Ins. N. Z., p. 112.

(D) On the Australian *L. juniperinum*, J. E. Smith, which, according to the Index Kewensis, is not distinct from *L. scoparium*. In Nicholson, Dict. Gard., it is given as a variety.

(1) *Asterolecanium* (*Planchonia*) *styphelicæ*, Maskell. Maskell, Tr. N. Z. Inst., XXIV, p. 25.

(E) On the Australian *L. flavescens*, J. E. Smith.

(1) *Sphærococcus pirogallis*, Maskell. Maskell, Tr. N. Z. Inst., XXVI, p. 95.

The species on the Australian genus *Melaleuca* are also numerous, namely:

(A) On *Melaleuca*, species not identified.

(1) *Planchonia* (=*Asterolecanium*) *styphelicæ*, Maskell. On dwarf *Melaleuca*. Maskell, Tr. N. Z. Inst., XXVII, p. 62.
(2) *Tessarobelus guerinii*, Montrouzier. Signoret, Essai.

(B) On *Melaleuca purpurea*, Hortorum. (=†, name not in Index Kewensis.)

(1) *Lecanium oleæ*, Bernard. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 28.

(C) On *M. ericifolia*, J. E. Smith.

(1) *Chionaspis eugeniæ*, Green. Maskell, Tr. N. Z. Inst., XXIV, p. 14.

(D) On *M. hypericifolia*, J. E. Smith.

(1) *Ceroplastes ceriferus*, Anderson. Maskell, Tr. N. Z. Inst., XXV, p. 216.

(E) On *M. linariifolia*, Smith.

(1) *Fiorinia expansa*, Maskell. Maskell, Tr. N. Z. Inst., XXVII, p. 51.
(2) *Sphærococcus froggatti*, Maskell. Maskell, Tr. N. Z. Inst., XXVI, p. 95.
(3) *S. melaleucæ*, Maskell. Maskell, Tr. N. Z. Inst., XXVI, p. 94.

(F) On *M. pustulata*, J. D. Hooker, and *M. uncinata*, Robert Brown.

(1) *Tachardia melaleucæ*, Maskell. Maskell, Tr. N. Z. Inst., XXIV, p. 55.

(G) On *M. nodosa*, Smith.

(1) *Mytilaspis nivea*, Maskell. Maskell, Tr. N. Z. Inst., XXVII, p. 46.
(2) *Aspidiotus rapax*, Comstock (syn. *camelliæ*, auctt.). Maskell, Tr. N. Z. Inst., XXVII, p. 39.

The Coccidæ found on *Eucalyptus* are extremely numerous, including the extraordinary Australian gall-making genera.

(A) On *Eucalyptus* spp., species not identified.

Mytilaspis grisea, Maskell.
M. cordylinidis, Maskell.
Chionaspis assimilis, Maskell.
C. eugeniæ, Maskell.
Aspidiotus eucalypti, Maskell.
A. subrubescens, Maskell.
A. rossi, Maskell.
Eriococcus coriaccus, Maskell.
Gossyparia confluens, Maskell.
Prosopophora eucalypti, Maskell.
Lecanium oleæ, Bernard.

(A) On *A. aurantii*, Maskell.
A. acaciæ, Morgan.
A. rapax, Comstock.
Sphærococcus inflatipes, Maskell.
Tachardia melaleucæ, Maskell.
Aspisarcus eucalypti, Newport.
Apiomorpha similis, Rübsaamen.
A. karschi, Rübsaamen.
A. cornifex, Rübsaamen.
A. dipsaciformis, Froggatt.
A. sessilis, Froggatt.
A. rosæformis, Froggatt.
A. urnalis, Tepper.
A. ellipsoidalis, Tepper, nomen nudum.
A. baeuerleni, Froggatt.
A. citricola, Schrader, nomen nudum.
A. crispa, Fuller.
A. nux, Olliff ms., Fuller.
A. pomiformis, Froggatt.
A. rugosa, Froggatt.
A. thorntoni, Froggatt.
A. umbellata, Froggatt.

(B) On *E. amygdalina*, Labill.
Dactylopius eucalypti, Maskell.

(C) On *E. capitellata*, J. E. Smith.
Aspidiotus extensus, Maskell.
Apiomorpha pharetrata, Schrader.
A. pileata, Schrader.

(D) On *E. corynocalyx*, F. Mueller.
Mytilaspis formosa, Maskell.

(E) On *E. corymbosa*, J. E. Smith.
Apiomorpha pharetrata, Schrader.

(F) On *E. diversicolor*, F. Mueller.
Eriococcus eucalypti, Maskell.

(G) On *E. dumosa*, A. Cunningham.
Sphærococcus elevans, Maskell.

(H) On *E. globulus*, Labillardiere.
Dactylopius lobulatus, Maskell.
Eriococcus tepperi, Maskell.

(I) On *E. goniocalyx*, F. Mueller.
Eriococcus paradoxus, Maskell.

(J) On *E. gracilis*, F. Mueller.
Apiomorpha munita, Schrader.
A. ovicola, Schrader.

(K) On *E. incrassata*, Labillardiere.
Apiomorpha strombylosa, Tepper.
A. ovicoloides, Tepper.

(L) On *E. hæmastoma*, Smith.
Apiomorpha duplex, Schrader.
A. minor, Froggatt.

Cælostoma immane, Maskell.

Monophlebus fuscus, Maskell.
Opisthoscelis globosa, Rübsaamen.
O. gracilis, Schräder.
O. serrata, Froggatt.
O. verrucula, Froggatt.
O. mammularis, Froggatt.
O. fibularis, Froggatt.

Apiomorpha pedunculata, Fuller.
A. schraderi, Fuller, emend.
A. fletcheri, Fuller.

Opisthoscelis subrotunda, Schrader.

Asterlis præmollis, Schrader.
A. schraderi, Froggatt.

Apiomorpha calycina, Tepper.
A. neumanni, Tepper.

Opisthoscelis maculata, Froggatt.

(L) On *A. oricola*, Schrader.
A. pileata, Schrader.
(M) On *E. leucoxylon*, F. Mueller.
Apiomorpha munita, Schrader. *Opisthoscelis maculata*, Froggatt.
A. oricola, Schrader.
(N) On *E. odorata*, Behr.
Apiomorpha ovicoloides, Tepper, is cited from this doubtfully.
(O) On *E. oleosa*, F. Mueller.
Apiomorpha calycina, Tepper.
(P) On *E. orbifolia*, F. Mueller.
Mytilaspis formosa, Maskell, is doubtfully cited from this.
(Q) On *E. robusta*, Smith.
Dactylopius eucalypti, Maskell. *Apiomorpha munita*, Schrader.
Opisthoscelis pisiformis, Froggatt.
(R) On *E. rostrata*, Schlecht.
Dactylopius eucalypti, Maskell. *Apiomorpha regularis*, Tepper.
A. glabra, Tepper.
(S) On *E. uncinata*, Turcz.
Apiomorpha subconica, Tepper.
(T) On *E. viminalis*, Labillardiere.
Eriococcus confusus, Maskell. *Apiomorpha conica*, Froggatt.
(U) On *E. siderophloia*, Bentham.
Ctenochiton eucalypti, Maskell. *Apiomorpha tricornis*, Froggatt.
Dactylopius eucalypti, Maskell. *Opisthoscelis maskelli*, Froggatt.
O. spinosa, Froggatt.
(V) On *E. sieberiana*, F. Mueller=*virgata*, Sieber.
Apiomorpha pharetrata, Schrader.
A. pileata, Schrader.
(W) On *E. piperita*, Smith.
Apiomorpha pileata, Schrader. *Opisthoscelis pisiformis*, Froggatt.
A. variabilis, Froggatt. *Ascelis attenuata*, Froggatt.
(X) On *E. melliodora*, A. Cunningham.
Opisthoscelis pisiformis, Froggatt.
(Y) On *E. resinifera*, Smith.
Opisthoscelis pisiformis, Froggatt.

On *Syncarpia laurifolia* is found *Fiorinia syncarpiæ*, Maskell.[1]

On *Metrosideros robusta*, A. Cunningham, a native of New Zealand, four species occur, namely: *Mytilaspis metrosideri*, Maskell, *Eriococcus pallidus*, Maskell, *Lecanochiton minor*, Maskell, and *L. metrosideri*, Maskell. The last-mentioned is also found on *M. tomentosa*, A. Richard.

The guava, *Psidium guava*, supports many Coccidæ. On a single guava tree in Kingston, Jamaica, I found *Lecanium oleæ*, Bernard, *Pulvinaria cupaniæ*, Cockerell, *Lecanium hemisphæricum*, Linnæus, *Vinsonia stellifera*, Westwood, *Aspidiotus articulatus*, Morgan, *A. personatus*, Comstock, *A. ficus*, Ashmead, and *Ceroplastes floridensis*, Comstock. Coquillett has also recorded *L. oleæ*, Bernard, from the guava. Signoret, in his Essai, records *Ceroplastes vinsonii*, Signoret, *C. psidii*, Chavannes, and *Aspidiotus destructor*, Signoret. I have recorded,

[1] Maskell, Tr. N. Z. Inst., XXV, p. 213.

in addition to the eight species above cited, *Pulvinaria pyriformis*, Cockerell.[1] ***Dactylopius*** *longifilis*, Comstock,[2] and *Aspidiotus rapax* Comstock.[3] Comstock has reported *Ceroplastes floridensis*, Comstock. Maskell cites *Pulvinaria psidii*, Maskell;[4] *Lecanium acuminatum*, Signoret;[5] *L. longulum*, Douglas,[6] and *L. depressum*, Targioni-Tozzetti.[7] Finally, there is the unrecognizable *Coccus trichodes*, Anderson. Thus, all told, the guava coccids number nineteen.

The common myrtle, ***Myrtus*** *communis*, is attacked by *Lecanium hesperidum*, Linnæus,[8] *Ceroplastes cirripediformis*, Comstock,[9] *C. floridensis*, Comstock,[9] ***Chionapsis*** *myrti*, Bouché (Signoret, Essai), and *Parlatoria myrtus*, Maskell.[10] *Lecanium nitens*, Cockerell, is found on *Myrtus tweediei* (***Blepharocalyx*** *tweedici*, Berg) in Brazil. *Coccus* ***erion***, Anderson, is reported from *Myrtus zeylanicus*, but the plant belongs properly to ***Eugenia***.

Eugenia is a very large tropical genus. On it are found the following:

(1) *Vinsonia stellifera*, Westwood. On *E.* (*Jambósa*) *malaccensis* and *E. jambolana*. Cockerell, Journ. Inst. Jamaica, I, p. 373; Insect Life, 1893, p. 160.

(2) *Lecanium mangiferæ*, Green. On *E. malaccensis*. Cockerell, Trans. Amer. Ent. Soc., 1893, p. 49.

(3) *Aspidiotus ficus*, Ashmead. On *E. jambolana*. Cockerell, Journ. Inst. Jamaica, I, p. 373.

(4) *A. fimbriatus*, Maskell. On *E. Smithii*, Poir. Maskell, Tr. N. Z. Inst., XXV, p. 208; Cockerell, Can. Ent., 1894, p. 128.

(5) *Chionaspis eugeniæ*, Maskell. On *E. elliptica*, a native of South America. Maskell, Tr. N. Z. Inst., XXIV, p. 14.

MELASTOMACEÆ.

Miconia is a very large neotropical genus. *Aspidiotus cyanophylli*, Signoret, is found on *M.* ***magnifica*** (syn. *Cyanophyllum magnificum*).

LYTHRACEÆ.

Lounsbury reports the occurrence of *Orthezia insignis*, Douglas, on *Cuphea*. *Aspidiotus articulatus*, Morgan, *A. personatus*, Comstock, *A. ficus*, Ashmead, and *Ceroplastes* sp. have been found on *Lawsonia alba* (syn. *inermis*).[11] ***Tachardia*** *lacca*, Kerr, occurs on the Indian *Lagerstræmia parviflora*, Roxburgh. On the pomegranate, *Punica granatum*,

[1] Journ. Trinidad Club, 1894, p. 309.
[2] Bull. Bot. Dept. Jamaica, August, 1893, p. 3.
[3] Journ. Inst. Jamaica, 1893, p. 255.
[4] Tr. N. Z. Inst. XXV, p. 223.
[5] Ibid., p. 219.
[6] Ibid., p. 221.
[7] Ibid., p. 220.
[8] Maskell, Scale Ins. N. Z., p. 113.
[9] Comstock, 2d Cornell Rept., p 140.
[10] Maskell, Tr. N. Z. Inst., XXIII, p. 12.
[11] Insect Life, V, p. 246.

are found *Ceroplastes floridensis*, Comstock, *Lecanium olea*, Bernard, *Aspidiotus punicæ*, Cockerell, *A. articulatus*, Morgan, and *A. personatus*, Comstock.

ONAGRACEÆ.

From *Fuchsia*, Coquillett reports *Aspidiotus aurantii*, Maskell, and *A. rapax*, Comstock, and Lounsbury, *Orthezia insignis*, Douglas. *Mytilaspis lactea*, Maskell, occurs on the New Zealand *F. excorticata*, Linnæus.[1]

PASSIFLORACEÆ.

Coquillett records *Aspidiotus aurantii*, Maskell, from passion flower. *Diaspis amygdali*, Tryon, has been found on the neotropical *Carica papaya*.

CACTACEÆ.

On *Mamillaria* (*Cactus*) have been found *Diaspis calyptroides*, Costa, and *Dactylopius mamillariæ*, Bouché. These two also on *Echinocactus* (Signoret, Essai). *Dactylopius virgatus*, Cockerell, has been found on an undetermined cactus.[2] *Eriococcus coccineus*, Cockerell, is from a cactus in a Nebraska greenhouse.

The following are reported from *Opuntia:*

(1) *Coccus cacti*, Linnæus. Cockerell, Amer. Nat., 1893, p. 1044. On *O. coccinellifera*. Signoret, Essai.
(2) *C. tomentosus*, Lamarck. Cockerell, Amer. Nat., 1893, p. 1044. On *O. tuna*, Miller.
(3) *C. confusus*, Cockerell. Cockerell, Amer. Nat., 1893, p. 1044. On *O. versicolor* and *O. leptocaulis*. Cockerell, Amer. Nat., 1895, p. 728.
(4) *Diaspis cacti*, Comstock. Found by Professor Toumey in Arizona on *O. fulgida* and *O. arborescens*. In New Mexico on *O. Engelmanni*, Garden and Forest, 1895.
(5) *D. cacti* var. *opuntiæ*, Cockerell. Cockerell, Journ. Inst. Jamaica, 1893, p. 256.
(6) *D. cacti* var. *opunticola*, Newstead. Ent. Mo. Mag., 1893. In Demerara.
(7) *Mytilaspis philococcus*, Cockerell. Bull. Soc. Zool. France, 1893, p. 252. In Mexico.
(8) *Dactylopius longispinus*, Targioni-Tozzetti (*longifilis*). On prickly pear cactus. Lintner, 2d N. Y. Rept., p. 56.

The *Opuntia coccinellifera* is more properly called *Nopalea coccinellifera*, Salm-Dyck. It is a native of Mexico.

FICOIDACEÆ.

On *Mesembryanthemum* is found *Pulvinaria mesembryanthemi*, Vallot;[3] *P. biplicata*, from *M. acinaciforme*, Linnæus, is the same insect.

[1] Maskell, Tr. N. Z. Inst., XXVII, p. 48.
[2] Cockerell, Can. Ent., 1895, p. 259.
[3] Douglas, Ent. Mo. Mag., 1887, p. 24.

UMBELLIFERÆ.

Concerning *Lecanium persicæ*, Fabricius, accidentally occurring on an umbellifer.[1] *Chionaspis bilobis*, Newstead, is found on *Pituranthos scoparius* (syn. *Deverra scoparia*, Cosson and Durand), in Algeria.[2] *Coccus pilosellæ*, Linnæus, a species not now recognized, was said to be found on *Pimpinella* as well as *Hieracium*. *Coccus halophilus*, Hardy (believed to be a *Ripersia*), occurred on *Ligusticum scoticum*. A *Dactylopius* was found by Mr. W. Fawcett on wild carrot at Cinchona, Jamaica, and transmitted to me by Professor Townsend, but the material was insufficient for determination.

ARALIACEÆ.

Gillette and Baker[3] report *Aspidiotus rapax*, Comstock (*camelliæ*), and *Lecanium hesperidum*, Linnæus, from *Aralia*. *A. guilfoylei*, Cogniaux and Marchand, a native of the Pacific islands, when cultivated in Jamaica, was attacked by *Aspidiotus articulatus*, Morgan, and *A. personatus*, Comstock.[4] On the New Zealand *Panax arboreum*, Forster, are found *Fiorinia minima*, Maskell, *Ctenochiton flavus*, Maskell, *C. fuscus*, Maskell, *C. perforatus*, Maskell, *C. viridis*, Maskell, and *Dactylopius glaucus*, Maskell.[5]

For an account of the Coccidæ found on ivy (*Hedera helix*) see Cockerell.[6] The species are *Phenacoccus hederæ*, Signoret, *Lichtensia viburni*, Signoret[7] *Lecanium maculatum*, Signoret, *L. hesperidum*, Linnæus, and var. *lauri*, *Aspidiotus hederæ*, Vallot (including *nerii?*), and *Asterolecanium hederæ*, Lichtenstein (syn. *massalongianum*).

CORNACEÆ.

Corokia is a genus of two species, confined to New Zealand. On *C. cotoneaster* are found, as reported by Maskell, *Solenophora corokiæ*, Maskell,[8] *Aspidiotus corokiæ*, Maskell,[9] and *Inglisia inconspicua*, Maskell.[10]

On *Cornus sanguinea* have been found *Lecanium corni*, Bouché, and *L. tarsale*, Signoret (Signoret, Essai); on *C. californicus* and other species, *Mytilaspis pomorum*, Bouché. Recently, Professor Harvey sent me *M. pomorum* on twigs of *Cornus* from Orono, Maine, with the remark

[1] Cockerell, Can. Ent., 1895, p. 256.
[2] Newstead, Ent. Mo. Mag., 1895, p. 233.
[3] Hemip. Colo., p. 128.
[4] Cockerell, Insect Life, V, p. 245.
[5] Maskell, Scale Ins. N. Z., p. 113.
[6] Ent. News, 1894, p. 210.
[7] Newstead, Ent. Mo. Mag., 1895, p. 166.
[8] Tr. N. Z. Inst., XXII, p. 142.
[9] Ibid., XXIII, p. 2.
[10] Ibid., XXIV, p. 20.

that it was abundant. Mr. C. F. Schaufuss sent *M. pomorum* on *Cornus alba, foliis variegatis*, from Meissen, Saxony.[1]

Chionaspis nyssæ, Comstock, was found in North Carolina on *Nyssa multiflora*, Wangerheim.

CAPRIFOLIACEÆ.

Signoret cites *Lichtensia viburni*, Signoret, and *Dactylopius viburni*, Signoret, from *Viburnum tinus*. From *Viburnum*, species not stated, Maskell records *Parlatoria myrtus*, Maskell,[2] and *Chionaspis eugeniæ*, Maskell.[3]

Coccus xylostei, Schrank, a species not now recognized, was found on *Lonicera xylosteum*, Linnæus. Comstock reports *Mytilaspis pomorum*, Bouché, as found on *Lonicera*.

RUBIACEÆ.

A large order. *Aspidiotus articulatus*, Morgan, is found on *Portlandia grandiflora*, Linnæus, in Jamaica.[4] At Pundaloya, Ceylon, Mr. E. E. Green found *Chionaspis aspidistræ*, Signoret, var. *mussændæ*, on *Mussænda frondosa*.

Gardenia jasminoides, Ellis (syn. *florida*, Linnæus), although called Cape Jessamine, is a native of China. Comstock records *Lecanium oleæ*, Bernard, upon it, and I have recorded *Pulvinaria cupaniæ*, Cockerell.[5]

In Jamaica, *Lecanium hemisphæricum*, Linnæus, is quite troublesome on *Ixora*.[6]

The species on coffee (*Coffea*) are as follows:

(1) *Dactylopius citri*, Boisduval. Cockerell, Entomologist, 1893, p. 267.

(2) *Lecanium viride*, Green. For full particulars about this insect see a pamphlet by Mr. E. E. Green, entitled Observations on the Green-scale Bug in connection with the Cultivation of Coffee, published in Ceylon, in 1886.

(3) *L. nigrum*, Nietner. See Green, Observations on the Green-scale Bug in connection with the Cultivation of Coffee, Ceylon, 1886.

(4) *L. coffeæ*, Walker. See Green, Observations on the Green-scale Bug in connection with the Cultivation of Coffee, Ceylon, 1886; Signoret, Essai. Also, for a discussion on the occurrence of this and *L. hemisphæricum*, Linnæus, on Coffee, and some remarks on their probable identity, see Cockerell, Bull. Bot. Dept., Jamaica, 1894, p. 71.

(5) *Orthezia insignis*, Douglas. On Liberian Coffee. E. E. Green, Tropical Agric., January, 1895.

(6) *Aspidiotus articulatus*, Morgan. Cockerell, Insect Life, V, p. 245.

[1] Can. Ent., 1895, p. 259.
[2] Tr. N. Z. Inst., XXIII, p. 12.
[3] Ibid., XXIV, p. 14.
[4] Cockerell, Insect Life, 1893, p. 160.
[5] Bull. Bot. Dept., Jamaica, 1895, p. 101.
[6] Insect Life, 1893, p, 160; Journ. Inst. Jamaica, 1895, p. 169.

On *Coprosma*, in New Zealand, Maskell finds:

Aspidiotus nerii, Bouché.
Mytilaspis pyriformis, Maskell.
Chionaspis dubia, Maskell.
Fiorinia asteliæ, Maskell.
Ctenochiton perforatus, Maskell.
C. viridis, Maskell.
C. depressus, var. *minor*, Maskell.
Inglisia patella, Maskell.
Dactylopius glaucus, Maskell.

Aspidiotus denticulatus, Targioni-Tozzetti, occurs on *Rubia*, but there seems to be some confusion as to whether the plant is *R. peregrina* or *R. tinctorum*.

On *Asperula cynanchica*, Linnæus, is found *Lecanopsis rhizophila*, Targioni-Tozzetti Maskell (Scale Ins. N. Z., p. 111) records *Lecanium maculatum*, Signoret, from "*Bavardia*," meaning, I suppose, *Bouvardia*.

COMPOSITÆ.

Lounsbury reports *Orthezia insignis*, Douglas, from *Ageratum;* also from *Steria*. From *Eupatorium* are recorded *Ceroplastes cirripediformis*, Comstock, *Orthezia americana*, Walker, and *O. insignis*, Douglas; the first two by Comstock, the other by Lounsbury.

Lecanium assimile, Newstead, was found, exogenetically, upon *Grindelia*. On *Bigelovia* in Colorado is found *Pulvinaria bigeloviæ*, Cockerell;[1] this same *Pulvinaria* was also sent to me by Doctor C. V. Riley, labeled as from *Bigelovia* in Los Angeles, California, (Div. Ent., 4757). Coquillett reports *Aspidiotus aurantii*, Maskell, exogenetically on *Solidago californica*. *Orthezia americana*, Walker, and *Icerya purchasi*, Maskell, have occurred on *Solidago*, the former doubtless normally, the latter accidentally.

Two species of *Olearia* have furnished coccids: *Eriochiton hispidus*, Maskell, was found on the New Zealand *O. haastii*, J. D. Hooker; *Tachardia melaleucæ*, Maskell, on *O. axillaris* (syn. *Aster axillaris*). *Rhizococcus celmisiæ*, Maskell, was found on *Celmisia*.[2]

On *Baccharis ciminalis* (rect. *viminea*, De Candolle) Coquillett found *Lecanium oleæ*, Bernard. In Brazil, *Ceroplastes albolineatus*, Cockerell, and *Lecanium baccharidis* are found on *Baccharis*. The unrecognized *Coccus capensis* was found on *Metalasia muricata* (syn. *Gnaphalium muricatum*). *Lecanium cassiniæ*, Maskell, a species formerly confounded with *L. oleæ*, is found on the New Zealand *Cassinia leptophylla*. On *Parthenium incanum* in New Mexico there occur *Lecaniodiaspis yuccæ*, Townsend, and *Tachardia cornuta*, Cockerell.[3] *Icerya purchasi*, Maskell, has been noticed by Coquillett exogenetically upon *Xanthium*. Maskell found *Dactylopius affinis*, Maskell, on tubers of *Dahlia*.[4]

Coquillett records *Aspidiotus aurantii*, Maskell, from *Bidens*. The cultivated *Chrysanthemum* is quite badly infested at times by *Lecanium hemisphæricum*, Targioni-Tozzetti and *Orthezia insignis*, Douglas.[5] *Cero-*

[1] Cockerell, Trans. Amer. Ent. Soc., XX, p. 366.
[2] Maskell, Scale Ins. N. Z., p. 111.
[3] Cockerell, Amer. Nat., 1895, p. 728.
[4] Tr. N. Z. Inst., XXVI, p. 90.
[5] Cockerell, Insect Life, 1892, p. 121; Trans. Amer. Ent. Soc., 1893, p. 55.

plastes cistudiformis, Cockerell, was found on *Chrysanthemum* in Mexico[1] Coquillett reports *Lecanium oleæ*, Bernard, from *Artemisia californica*, Lessing. *Ceroplastes artemesiæ* (sic), of Riley's Manuscript, found on *Artemisia* in Silver City, New Mexico, has never been described. The European *C. artemisiæ*, Rossi, is not the same, but is considered identical with *C. rusci*.

On the New Zealand *Brachyglottis repanda*, Maskell, was found *Fiorinia minima*, Maskell, *Ctenochiton flavus*, Maskell, and *C. fuscus*, Maskell. Lounsbury records *Orthezia insignis*, Douglas, from *Cineraria*. *Aspidiotus signoreti*, Comstock (syn. *Targionia nigra*), was found on *Cineraria maritima*, more properly called *Senecio cineraria*. On burdock (*Arctium*) has been found *Orthezia americana*, Walker; *Guerinia serratulæ*, Fabricius, is from *Serratula tinctoria*. *Coccus pilosellæ*, Linnæus, is from roots of *Hieracium pilosella*. Coquillett found *Lecanium oleæ*, Bernard, and *Icerya purchasi*, Maskell, exogenetically on *Sonchus oleraceus*.

GOODENOVIACEÆ.

On the Australian *Goodenia ovata*, J. E. Smith, has been found *Icerya ægyptiaca*, Douglas.[2]

VACCINIACEÆ.

Chionaspis vaccinii, Bouché, is found on *Vaccinium myrtillus* in Switzerland. Two other coccids on the same plant are the *Coccus myrtilli*, of Kaltenbach, 1874, a species not known to Signoret, and *Lecanium distinguendum* of Douglas. R. Goethe has described a species as *Lecanium vaccinii-macrocarpum*, found in the botanical garden at Karlsruhe. Professor J. B. Smith records an *Aspidiotus*, either *A. ancylus* Putnam, or a very closely allied form, from cranberry.

ERICACEÆ.

Coquillett reports *Aspidiotus nerii*, Bouché, on *Arbutus menziesii*, Pursh. The unrecognized *Coccus uvæ-ursi*, Linnæus, was from roots of *Arctostaphylos uva-ursi* (syn. *Arbutus uva-ursi*). Comstock has recorded *Ceroplastes floridensis*, Comstock, from *Andromeda*, and *Lecanium oleæ*, Bernard, from heath. In Europe *Orthezia mœnariensis*, Douglas, is found on *Erica arborea*, Linnæus, and *Aspidiotus ericæ*, Boisduval, and *Eriococcus ericæ*, Signoret, on *E. mediterranea*, Linnæus. Maskell describes *Dactylopius ericicola*, Maskell, from *Erica autumnalis*; this name is not in the Index Kewensis, however. *Eriococcus azaleæ*, Comstock, is from *Azalea*. Maskell has reported *Aspidiotus rapax*, Comstock (*camelliæ*), from *Rhododendron*.[3]

[1] Cockerell, Zoe, 1893, p. 104.
[2] Maskell, Tr. N. Z. Inst., XXVI, p. 100.
[3] Tr. N. Z. Inst., XXVII, p. 39.

EPACRIDEÆ.

Asterolecanium styphelia, Maskell, is recorded by Maskell from *Styphelia richei*[1] and *Monotoca elliptica*.[2] On the Australian *Cyathodes acerosa* are found *Poliaspis media* and *Eriococcus multispinus*.[3] On *Leucopogon fraseri*, A. Cunningham, also a native of Australia, are *Poliaspis media*, Maskell, and *Asterolecanium epacridis*, Maskell.[3] On *Epacris longifolia* is *Eriococcus multispinus*, Maskell, var. *lævigatus*.[4] Is it not probable that the species found by Maskell on Australian Epacrideæ in New Zealand are really natives of Australia? If so, one or two apparent anomalies are removed.

PLUMBAGINEÆ.

At roots of *Statice armeria* (*Armeria vulgaris*) Newstead found his *Dactylopius radicum*.[5] *Coccus halophilus*, Hardy, had much earlier been reported from the same plant. *Icerya purchasi*, Maskell, and *Ceroplastes plumbaginis*, Cockerell, have been found on *Plumbago*.

MYRSINEÆ.

Aspidiotus myrsinæ was found on *Myrsine africana*, Linnæus (syn. *retusa*). *Vinsonia stellifera*, Westwood, is recorded from *Ardisia polycephala*.[6]

SAPOTACEÆ.

On the star apple, *Chrysophyllum cainito*, are found *Dactylopius longispinus*, Targioni-Tozzetti (syn. *longifilis*), *Ceroplastes floridensis*, Comstock, *Lecanium oleæ*, Bernard, *Pulvinaria cupaniæ*, Cockerell, *Aspidiotus articulatus*, Morgan, and *A. personatus*, Comstock.[7] Comstock has reported *Chionaspis biclavis*, Comstock, from *Achras sapota*; and from the same plant I have recorded *Vinsonia stellifera*, Westwood.[8] Hart[9] reports *Aspidiotus destructor*, Signoret, and *Lecanium mangiferæ*, Green, from *Bassia latifolia*, Roxburgh, an East Indian tree cultivated in Trinidad. It will be observed that the coccids are also East Indian species.

[1] Tr. N. Z. Inst., XXIV, p. 25.
[2] Tr. N. Z. Inst., XXVII, p. 67.
[3] Maskell, Scale Ins. N. Z., p. 112.
[4] Maskell, Tr. N. Z. Inst., XXVII, p. 64.
[5] Ent. Mo. Mag., 1895, p. 236.
[6] Cockerell, Ent. Mo. Mag., 1893, p. 17.
[7] Insect Life, VI, p. 103, also 1893, p. 159.
[8] Insect Life, 1893, p. 159.
[9] Bull. Misc. Inform. Bot. Gard., Trinidad, April, 1895, p. 38.

EBENACEÆ.

On persimmon (*Diospyros*) *Diaspis amygdali*, Tryon, has been found.[1] Comstock records *Chionaspis biclavis*, Comstock, from *Diospyros ebenum*, Koenig.

OLEACEÆ.

On *Jasminum* have been found:

(1) *Lecanium mangiferæ*, Green. On *J. sambac*, Aiton, a native of tropical Asia, in cultivation in Jamaica. Cockerell, Insect Life, V, p. 246.
(2) *Aspidiotus articulatus*, Morgan. On *J. sambac*. Cockerell, Insect Life, V, p. 246.
(3) *A. personatus*, Comstock. On *J. pubescens*, Willdenow; also a native of tropical Asia, cultivated in Jamaica. Cockerell, Insect Life, V, p. 246.
(4) *A. diffinis*, Newstead, var. *lateralis*, Cockerell. On *J. pubescens*. Cockerell, Can. Ent., 1894, p. 130.
(5) *Diaspis amygdali*, Tryon,=*lanatus*. Cockerell, Journ. Inst., Jamaica, I, p. 373.

Coquillett records *Aspidiotus nerii*, Bouché, from *Syringa vulgaris*. From lilac Maskell also reports *Mytilaspis pomorum*, Bouché.

The species found on *Fraxinus* are rather numerous, thus:

(1) *Pulvinaria fraxini*, Signoret. On *F. excelsior*. Signoret. Essai.
(2) *P. innumerabilis*, Rathvon. On *F. nigra* (*sambucifolia*). Mundt. Can. Ent., 1884, p. 240.
(3) *Lecanium pruinosum*, Coquillett. Coquillett, Insect Life, III, p. 384.
(4) *L. oleæ*, Bernard. Coquillett, Bull. 26, Div. Ent., U. S Dept. Agric., p. 28. Comstock cites it from Oregon ash.
(5) *L. hesperidum*, Linnæus. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 26.
(6) *Coccus fraxini*, Chavannes, 1848. Said sometimes to produce manna. Not now recognized.
(7) *Chionaspis fraxini*, Signoret. Signoret, Essai; Gillanders, Brit. Nat., 1894, p. 23. On *F. excelsior*. Comstock considers it identical with *C. salicis*.
(8) *Mytilaspis pomorum*, Bouché. On *F. americana* and *F. nigra* (*sambucifolia*). Country Gentleman, January 10, 1895, p. 27. Also reported from ash by Maskell.
(9) *Aspidiotus ancylus*, Putnam. Comstock, 2d Cornell Rept., p. 139.
(10) *A. juglans-regiæ*, Comstock, var. *albus*, Cockerell. Cockerell, Insect Life, VII, p. 211; Can. Ent., 1894, p. 287. Formerly recorded by Townsend as *A. convexus*.

On the olive (*Olea europea*, Linnæus, with syn. or var. *hispanica*) are found:

(1) *Pollinia pollini*, Costa (syn. *costæ*). Signoret, Essai.
(2) *Lecanium oleæ*, Bernard. Signoret, Essai. In Jamaica, although *L. oleæ* is common, it does not attack the olive. Cockerell, Bull. Bot. Dept., Jamaica, 1894, p. 72.
(3) *Mytilaspis flava*, Targioni-Tozzetti. Signoret, Essai; Comstock, 2d Cornell Rept., p. 140.
(4) *Aspidiotus villosus*, Targioni-Tozzetti. Signoret, Essai; Comstock, 2d Cornell Rept., p. 140.
(5) *A. articulatus*, Morgan. Cockerell, Insect Life, 1893, p. 160.
(6) *A. personatus*, Comstock. Cockerell, Insect Life, 1893, p. 160.
(7) *A. ficus*, Ashmead. Cockerell, Journ. Inst. Jamaica, I, p. 373.

[1] Cockerell, Can. Ent., 1895, p. 260.

(8) *A. rapax*, Comstock. Comstock, 2d Cornell Rept., p. 140.
(9) *Lichtensia catoni*, Newstead. Newstead, Ent. Mo. Mag., 1895, p. 166.
(10) *Filippia oleæ*, Costa (syn. *follicularis*). Signoret, Essai. Lichtenstein described the male in 1881.

On *Ligustrum lucidum* (syn. *japonicum*) are found *Lecanium oleæ*, Bernard,[1] and *Ericerus pe-la*.[2]

APOCYNACEÆ.

Phenacoccus barberi, Cockerell, has been noticed on *Allamanda*.[3] Watt[4] records *Tachardia lacca* from *Carissa carandas*, Linnæus. *Aspidiotus personatus*, Comstock, and *A. articulatus*, Morgan, have been found on *Thevetia neriifolia*.[5] Lounsbury records *Orthezia insignis*, Douglas, from *Vinca*. *Lecanium hemisphæricum*, Targioni-Tozzetti, infests *Tabernæmontana*.[6] Maskell has reported *Chionaspis minor*, Maskell, from *Parsonia*.

The coccids of the oleander (*Nerium oleander*, Linnæus) are:

(1) *Lecanium oleæ*, Bernard. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric.; Cockerell, Insect Life, VI, p. 103.
(2) *L. hesperidum*, Linnæus. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric.; Cockerell, Insect Life, VII, p. 210. Also var. *lauri*. Ent. Mo. Mag., 1891, p. 245.
(3) *Ceroplastes floridensis*, Comstock. Comstock, 2d Cornell Rept., p. 140. Also a pink form, possibly *myricæ*. Cockerell, Journ. Inst. Jamaica I, p. 373.
(4) *Asterolecanium pustulans*, Cockerell. Cockerell, Insect life, VI, p. 103. Quite troublesome on oleander. See also Sci. Gossip., 1893, p. 78; Ent. Mo. Mag., 1893, p. 17; Journ. Inst. Jamaica, 1892, p. 143; Can. Ent., 1895, p. 259.
(5) *Diaspis amygdali*, Tryon (=*lanatus*). Cockerell, Insect Life, VI, p. 103.
(6) *Chionaspis nerii*, Newstead. Newstead, Ent. Mo. Mag., 1895, p. 235. In Algeria.
(7) *Aspidiotus rossi*, Maskell. Maskell, Tr. N. Z. Inst., XXIV, p. 12.
(8) *A. personatus*, Comstock. Cockerell, Insect Life, 1893, p. 160.
(9) *A. ficus*, Ashmead. Cockerell, Insect Life, 1893, p. 160; also Insect Life, VI, p. 103.
(10) *A. nerii*, Bouché. Signoret, Essai, and most other authors.
(11) *A. articulatus*, Morgan. Cockerell, Insect Life, VI, p. 103; Journ. Inst. Jamaica, 1892, p. 54.

An *Aspidiotus*, apparently not separable from *aurantii*, Maskell, is found on *Plumieria* in Kingston, Jamaica.

On *Trachelospermum* (or *Rhynchospermum*) *jasminoides* Gillette and Baker record *Lecanium hesperidum*, Linnæus.[7]

ASCLEPIADACEÆ.

Ripersia terrestris, Newstead, was found on roots of *Stephanotis*.[8] *Aspidiotus personatus*, Comstock, and *Diaspis amygdali*, Tryon

[1] Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric.
[2] Alex. Hosie, Insect Life, III, p. 424.
[3] Cockerell. Ann. Mag. Nat. Hist., 1895, p. 61.
[4] Dict. Ec. Prod. Ind., II, p. 410.
[5] Cockerell, Insect Life, V, p. 246.
[6] Cockerell, Bull. Bot. Dept., Jamaica, 1894, p. 71.
[7] Hemip. Colo., p. 127.
[8] Newstead, Ent. Mo. Mag., 1895, p. 214.

(=*lanatus*), have occurred on *Calotropis procera*.[1] On *Hoya carnosa*, Robert Brown, a native of the Eastern tropics, Signoret records *Dactylopius hoyiæ*, Signoret (rect. *hoyæ*).

LOGANIACEÆ.

On the New Zealand *Geniostoma ligustrifolium*, Maskell found *Ctenochiton elongatus*, Maskell. *Aspidiotus buddleiæ*, Signoret (rect. *buddleiæ*), is variously reported by Signoret, Comstock, and Maskell from *Buddleia globulosa* and *B. salicina*. These two specific names must be erroneous, as they are not in the Index Kewensis; there is a *globosa* and a *salicifolia*.

BORAGINACEÆ.

On heliotrope (*Heliotropium*) Lounsbury reports *Orthezia insignis*, Douglas, while I have recorded *Chionaspis major*, Cockerell.[2] *Phenacoccus brunnitarsis*, Signoret, is recorded by Signoret from *Borago officinalis*, Linnæus. I have recorded *Orthezia insignis*, Douglas, from *Myosotis*.[3]

CONVOLVULACEÆ.

The Old World *Argyreia speciosa*, when cultivated in Jamaica, is attacked by *Diaspis amygdali*, Tryon (=*lanatus*).[3] Lounsbury reports *Orthesia insignis*, Douglas, from *Ipomœa*. *Lecanium batatæ*, Cockerell, is found on roots of *Ipomœa batatas*.[4]

SOLANACEÆ.

The coccids of *Solanum* are:

(1) *Dactylopius solani*, Cockerell. On roots of *S. tuberosum* and *S. rostratum*. Cockerell, Amer. Nat., 1895, p. 729; Can. Ent., 1894, p. 286.
(2) *Dactylopius* sp., on *S. melongena*. In Jamaica. Cockerell, Ent., 1893, p. 266.
(3) *D. affinis*, Maskell. On tubers of potato. Maskell, Tr. N. Z. Inst., XXVI, p. 90.
(4) *D. citri*, Boisduval. On *S. jasminoides*. Gillette and Baker, Hemip. Colo., p. 125.
(5) *Ceroplastes cirripediformis*, Comstock. On soushumber. Cockerell, Journ. Inst. Jamaica, 1892, p. 54.
(6) *Lecanium oleæ*, Bernard. On soushumber. Cockerell, Journ. Inst. Jamaica, 1892, p. 54. On bittersweet (Comstock); on *S. jasminoides* (Gillette and Baker, Hemip. Colo., p. 127); on *S. douglasii* (Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric.).
(7) *Orthezia insignis*, Douglas. On *S. tuberosum*. Cockerell, Insect Life, V, p. 247.
(8) *Icerya purchasi*, Maskell. Coquillett, Rept. Dept. Agric. for 1888.
(9) *Pseudoparlatoria ostreata*, Cockerell. On soushumber. Cockerell, Journ. Inst. Jamaica, 1892, p. 136.

[1] Cockerell, Insect Life, V, p. 246.
[2] Can. Ent., 1894, p. 127.
[3] Insect Life, V, p. 247.
[4] Cockerell, Ann. Mag. Nat. Hist., 1895, p. 62.

(10) *Aspidiotus aurantii*, Maskell. On *S. douglasii*. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric.

(11) *A. nerii*, Bouché. On *S. douglasii*. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric.

(12) *Coccus koleos*, Anderson. On *S. melongena*. See Signoret, Essai.

Two species have been found on the tomato, *Lycopersicum lycopersicum* (*Solanum lycopersicum*, *Lycopersicum esculentum*). These are the unrecognizable *Coccus trichodes*, Anderson, and an undetermined *Dactylopius* on the roots.[1] It is quite probable that the *Dactylopius* was *D. solani*, Cockerell.

The following have been recorded from red pepper (*Capsicum*):

(1) *Lecanium oleæ*, Bernard. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric.

(2) *Pulvinaria urbicola*, Cockerell. Cockerell, Trans. Ent. Soc. Lond., 1893, p. 160.

(3) *Chionaspis minor*, Maskell. Cockerell, Ent. Mo. Mag., 1893, p. 17.

(4) *Diaspis amygdali*, Tryon (=*lanatus*). Cockerell, Journ. Inst. Jamaica, 1892, p. 137.

The following are recorded from *Cestrum* (including *Habrothamnus*):

(1) *Dactylopius citri*, Boisduval. On *Habrothamnus*. Gillette and Baker, Hemip. Colo., p. 125.

(2) *Lecanium oleæ*, Bernard. On *C.* (*H.*) *elegans*. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric. See also Comstock, 2d Cornell Rept., p. 139.

(3) *Pulvinaria cestri*, Signoret. Signoret Essai.

(4) *Coccus tuberculatus*, Bouché. Signoret, Essai. A species of unknown relationships.

Lecanium ollæ, Bernard, is recorded[2] from *Meyenia alba*, but there is no such name in Index Kewensis. Is it *Cestrum album*?

Lounsbury records *Orthezia insignis*, Douglas, from *Petunia*. *Aspidiotus articulatus*, Morgan, has been observed on *Brunfelsia americana*.[3]

SCROPHULARIACEÆ.

Dactylopius calceolariæ of Maskell occurs on *Calceolaria*. Maskell records *Poliaspis media*, Maskell, and *Lecanium hesperidum*, Linnæus, from *Veronica;* Gillette and Baker[4] cite *L. hesperidum*, Linnæus, from *V. hendersonii*. *Coccus pilosellæ*, Linnæus, a doubtful species, is found on *Melampyrum arvense*, Linnæus, and *M. nemorosum*, Linnæus.

OROBRANCHACEÆ.

Dactylopius aphyllonis, Cockerell, is from *Aphyllon fasciculatum*.[5]

BIGNONIACEÆ.

On *Bignonia magnifica*, Bull, have occurred *Pulvinaria cupaniæ*, Cockerell, *Aspidiotus articulatus*, Morgan, and *A. ficus*, Ashmead[6]

[1] Insect Life, III, p. 413.

[2] Cockerell, Insect Life, 1893, p. 160.

[3] Cockerell, Insect Life, 1893, p. 159.

[4] Hemip. Colo., p. 127.

[5] Cockerell, Psyche Supp., 1895, p. 8.

[6] Cockerell, Insect Life, V, p. 246.

Ceroplastes cistudiformis, Cockerell, has been found on *Bignonia*.[1] Coquillett has reported *Icerya purchasi*, Maskell, from *Tecoma*. *Dolichandrone rheedii*, Seeman, is cited by Watt as a food plant of *Tachardia lacca*, Kerr.

ACANTHACEÆ.

Phenacoccus barberi, Cockerell, has been observed on *Thunbergia grandiflora*.[2] *Diaspis amygdali*, Tryon (= *lanatus*), occurs on *Acanthus*.[3] *Eranthemum variegatum* (this name not in Index Kewensis) is freely attacked by *Lecanium hemisphæricum*, Targioni-Tozzetti, while *Orthezia insignis*, Douglas, also occurs upon it.[4] Lounsbury records *Orthezia insignis*, Douglas, from *Vacobinia* (syn. *Libonia*), also from *Peristrophe*. From *Hygrophila spinosa*, T. Anderson, Newstead describes his *Pulvinaria obscura* and *Dactylopius viridis*. *Orthezia prælonga*, Douglas, occurs on *Sanchezia*.[5]

MYOPORACEÆ.

The following have been found on *Myoporum* (frequently misspelled *Myosporum*):

(1) *Icerya purchasi*, Maskell. Coquillett, Rept. Dept. Agric. for 1888, p. 84.
(2) *Eriococcus pallidus*, Maskell. On the New Zealand *M. latum*, Forster. Maskell, Tr. N. Z. Inst., XXIII, p. 21.
(3) *Lecanium oleæ*, Bernard. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric.
(4) *Pulvinaria dodonææ*, Maskell. Maskell, Tr. N. Z. Inst., XXV, p. 223.
(5) *Aspidiotus rapax*, Comstock. Coquillett. Bull. 26, Div. Ent., U. S. Dept. Agric.

VERBENACEÆ.

Lounsbury records *Orthezia insignis*, Douglas, from *Lippia* (syn. *Aloysia*); the same insect is also found on *Lantana* and *Verbena*. *Tectona grandis* is a food plant of *Tachardia lacca*, Kerr. Maskell reports *Aspidiotus carpodeti*, Maskell, from *Vitex littoralis;* he also records *Diaspis santali*, Maskell, from *Vitex*.[6]

LABIATÆ.

Coleus, and according to Lounsbury especially *C. verschaffeltii*, is badly infested by *Orthezia insignis*, Douglas.[7] *Phenacoccus barberi*, Cockerell, has occurred on *Coleus*.[8] *Dactylopius lavandulæ*, Signoret,

[1] Cockerell, Zoe, 1893, p. 104.
[2] Cockerell, Ann. Mag. Nat. Hist., 1895, p. 61.
[3] Cockerell, Journ. Inst. Jamaica, I, p. 373.
[4] Cockerell, Journ. Trinidad Club, 1894, p. 307; Trans. Amer. Ent. Soc., 1893, p. 55; Maskell, Tr. N. Z. Inst., XXVII, p. 59.
[5] Ent. Mo. Mag., 1891, p. 247.
[6] Tr. N. Z. Inst., XXII, p. 135.
[7] Lounsbury, Ann. Rept. Mass. Coll. for 1894; Cockerell, Ent., 1892, p. 181; Ann. Mag. Nat. Hist, 1895, p. 60.
[8] Cockerell, Ann. Mag. Nat. Hist., 1895, p. 61.

occurs on *Lavandula stœchas*, Linnæus. From *Mentha* I have recorded *Orthezia insignis*, Douglas, and some juvenile Lecaniine.[1] *Eriococcus thymi*, Schrank, is found on *Thymus vulgaris*.

From *Salvia* are known:

(1) *Icerya purchasi*, Maskell. Coquillett, Rept. Dept. Agric. for 1888.
(2) *Lecanium hemisphæricum*, Targioni-Tozzetti, var. Cockerell, Trans. Amer. Ent. Soc., 1893, p. 55.
(3) *Orthezia insignis*, Douglas, Lounsbury, Ann. Rept. Mass. Coll. for 1894.

From *Rosmarinus officinalis* comes *Eriococcus rorismarinis*, Fonscolombe (rect. *rosmarini*). Coquillett has reported *Icerya purchasi*, Maskell, from *Rosmarinus* and also from *Nepeta*.

PLANTAGINACEÆ.

Coquillett records *Icerya purchasi*, Maskell, from *Plantago*.[2]

ILLECEBRACEÆ.

Coccus pilosellæ, Linnæus, is recorded from roots of *Herniaria*.

AMARANTACEÆ.

Orthezia insignis, Douglas, is recorded by Lounsbury from *Celosia* and *Alternanthera*.

CHENOPODIACEÆ.

Olliff reports his *Pulvinaria maskelli* from *Rhagodia hastata*.[3] *Orthezia annæ*, Cockerell, is recorded from *Chenopodium*.[4] *Signoretia atriplicis* of Maskell[5] was from an *Atriplex*, perhaps *A. halimus*, Linnæus. It afterwards proved that this insect was not a *Signoretia*, but a *Pulvinaria*, being in fact identical with *P. maskelli*, Olliff. Olliff has recorded *P. maskelli*, Olliff, from *A. vesicaria*, Hew, and *A. nummularia*, Lindley.[6] The following six species are found on *Atriplex canescens* in New Mexico:

1. *Dactylopius solani* var. *atriplicis*, Cockerell.
2. *Orthezia annæ*, Cockerell.
3. *Mytilaspis albus*, Cockerell, var. *concolor*, Cockerell.
4. *Lecaniodiaspis yuccæ* vár. *rufescens*.
5. *Ceroplastes irregularis*.
6. *Eriococcus neglectus*.

(See Amer. Nat., 1895, p. 730; Psyche Supp., 1895, p. 8; Ann. Mag. Nat. Hist., 1893, p. 403; Can. Ent., 1894, p. 285.)

[1] Insect Life, V, p. 247.
[2] Rept. Dept. Agric. for 1888.
[3] Agric. Gaz. of New South Wales, November, 1891, p. 667.
[4] Cockerell, Can. Ent., 1894, p. 285.
[5] Tr. N. Z. Inst., XXIV, p. 24; XXVI, p. 77.
[6] Agric. Gaz., N. S. W., November, 1891, p. 667; also III, p. 178.

On greasewood (*Sarcobatus vermiculatus*) are found *Lecaniodiaspis yuccæ*, Townsend, var. *rufescens*, Cockerell, and *Orthezia annæ*, Cockerell.[1]

POLYGONACEÆ.

Coquillett has recorded *Icerya purchasi*, Maskell, from *Polygonum*. *Ripersia rumicis*, Maskell, was found at the roots of *Rumex acetosella*.[2] *Dactylopius arecæ*, Maskell, has occurred on dock.[3] Maskell[4] records *Fiorinia stricta*, Maskell, *Eriochiton spinosus*, Maskell, and *Cœlostoma zelandicum*, Maskell, from *Muhlenbeckia adspersa*, but the species intended is doubtless *M. adpressa;* there is no *M. adspersa*.

ARISTOLOCHIACEÆ.

The unrecognizable *Coccus asari*, Schrank, is from *Asarum europæum*, Linnæus. Mr. Hart has sent me *Lecanium hemisphæricum*, Targioni-Tozzetti, on *Aristolochia* from Trinidad.

PIPERACEÆ.

From *Piper excelsum*, Forster, Maskell[4] records *Ctenochiton piperis*, Maskell, and *Dactylopius glaucus*, Maskell.

MYRISTICACEÆ.

On the nutmeg (*Myristica fragrans*) there has been found *Vinsonia stellifera*, Westwood.[5]

MONIMIACEÆ.

Fiorinia stricta, Maskell, occurs on *Hedycarya*. *Atherosperma* is a small genus, with a species in New Zealand, two in Australia, and one in Chile. On *A. novæzealandiæ*, Hooker, Maskell records the following seven species:

1. *Aspidiotus atherospermæ*, Maskell.
2. *Fiorinia gigas*, Maskell (*asteliæ*).
3. *Mytilaspis pyriformis*, Maskell.
4. *Ctenochiton viridis*, Maskell.
5. *Inglisia patella*, Maskell.
6. *Eriochiton spinosus*, Maskell,
7. *Eriococcus pallidus*, Maskell.

(For the first six, see Scale Ins. N. Z., p. 111; for the seventh, Tr. N. Z. Inst., XXIII, p. 21.)

[1] Gillette and Baker, Hemip. Colo., p. 127.
[2] Maskell, Tr. N. Z. Inst., XXIV, p. 37.
[3] Maskell, Tr. N. Z. Inst., XXV, p. 231.
[4] Scale Ins., N. Z. p. 113.
[5] Cockerell, Bull. Bot. Dept., Jamaica, 1895, p. 101.

LAURINACEÆ.

From the camphor tree (*Cinnamomum camphora*) Coquillett records *Aspidiotus aurantii*, Maskell. *Pulvinaria pyriformis*, Cockerell, is found on cinnamon.[1] From *Persea borbonia* (syn. *carolinensis*) Comstock records *Aspidiotus perseæ*, Comstock, and *A. parlatorioides*, Comstock—the latter being really a *Pseudoparlatoria*. He also reports *Ceroplastes floridensis*, Comstock, from the same tree. From *Persea persea* I have recorded *Aspidiotus articulatus*, Morgan, and *A. personatus*, Comstock.[2] *Lecanium lintneri*, Cockerell and Bennett, is found on sassafras. *Aspidiotus rapax*, Comstock, occurs on *Umbellularia californica*. On *Laurus nobilis*, Linnæus, of the Mediterranean region, are *Aonidia lauri*, Bouché, *Lecanium lauri*, Boisduval, and *Boisduvalia lauri*, as recorded by Signoret. Maskell records two other species from *L. nobilis*, namely, *Aspidiotus aurantii*, Maskell, and *Lecanium tessellatum*, Signoret.[3] He also reports *L. hesperidum*, Linnæus, from laurel. *Dactylopius indicus*, Signoret, is from *Laurus indicus*, Linnæus, but the plant is more properly called *Persea indica*.

PROTEACEÆ.

Coquillett has reported *Lecanium oleæ*, Bernard, from *Grevillea robusta*, A. Cunningham, a native of Australia. He records *Aspidiotus rapax*, Comstock, from *Leucadendron argenteum*, Robert Brown. From *Hakea* are known:

(1) *Icerya australis*, Maskell. On the Australian *H. gibbosa*, Cavanilles. Maskell, Tr. N. Z. Inst., XXVI, p. 101.
(2) *Lecanium depressum*, Targioni-Tozzetti. Maskell, Tr. N. Z. Inst., XXV, p. 220.
(3) *Aspidiotus acaciæ* var. *propinqua*, Maskell. On the Australian *A. saligna*, Knight. Maskell, Tr. N. Z. Inst., XXV, p. 206.

Eriococcus multispinus, Maskell, was found on the New Zealand *Knightia excelsa*, Robert Brown.

The following are from *Banksia:*

(1) *Colostoma rubiginosum*, Maskell. On the Australian *B. integrifolia*. Maskell, Tr. N. Z. Inst., XXV, p. 243.
(2) *Ceronema banksiæ*, Maskell. On *B. serrata*. Maskell, Tr. N. Z. Inst., XXVII, p. 57.
(3) *Lecanium frenchii*. On *B. marginata*, Cavanilles (syn. *australis*). Maskell, Tr. N. Z. Inst., XVIII, p. 17.
(4) *Aspidiotus subrubescens*, Maskell. Maskell, Tr. N. Z. Inst., XXV, p. 207.
(5) *Mytilaspis grandilobis*, Maskell. Maskell, Tr. N. Z. Inst., XXVI, p. 71.
(6) *M. citricola*, Packard. On *B. integrifolia*. Maskell, Tr. N. Z. Inst., XXVII, p. 48.

THYMELÆACEÆ.

Signoret cites *Aspidiotus caldesii*, Targioni-Tozzetti, from *Daphne collina;* and *A. gnidii* and *Rhizococcus gnidii*, Signoret, from *D. gnidium*. These plants are European, as well as the coccids.

[1] Cockerell, Bull. Bot. Dept., Jamaica, 1895, p. 102.
[2] Insect Life, 1893, p. 160.
[3] Tr. N. Z. Inst., XXV, pp. 206, 219.

ELÆAGNACEÆ.

Mr. E. E. Green, in the prospectus of his work on the Coccidæ of Ceylon, describes *Chionaspis elæagni* from *Elæagnus latifolia* in Ceylon. *Chionaspis difficilis*, Cockerell, and *Mytilaspis crawii*, Cockerell, are found on *Elæagnus* in Japan.[1]

LORANTHACEÆ.

For a note on the coccids peculiar to Loranthaceæ, see Cockerell.[2] *Diaspis visci*, Schrank, is from *Viscum album*. From *Phoradendron* comes *Lecanium phoradendri*, Cockerell. Mr. W. G. Johnson has sent me some *Phoradendron flavescens* from Palo Alto, California, on which are *Lecanium oleæ*, Bernard, and a form of *Aspidiotus rapax*, Comstock. On *Dendrophthora cupressoides*, Eichler, in Jamaica, have been found *Pulvinaria dendrophthoræ*, Cockerell, and *Lecanium hemisphæricum*, Targioni-Tozzetti.[3]

SANTALACEÆ.

From *Santalum* are known:

(1) *Rhizococcus fossor*, Maskell. On *S. cunninghamii*. Maskell, Scale Ins., N. Z., p. 114.
(2) *Inglisia foraminifer*, Maskell. On *S. acuminatum*. Maskell, Tr. N. Z. Inst., XXV., p. 213.
(3) *Diaspis santali*, Maskell. On *S. cunninghamii*. Maskell, Scale Ins., N. Z., p. 114.
(4) *Poliaspis exocarpi*. Maskell. Maskell, Tr. N. Z. Inst., XXVI, p. 72.

From *Exocarpus cupressiformis*, a native of Australia, Maskell records *Poliaspis exocarpi*. Maskell.

EUPHORBIACEÆ.

The unrecognizable *Coccus oogenes*, Anderson, was found on *Euphorbia pilulifera* (syn. *hirta*). *Lecanium longulum*, Douglas, and *Icerya rosæ*, Riley and Howard, have occurred on *Euphorbia*—the latter on a cactoid species.[4] Coquillett records *Aspidiotus aurantii*, Maskell, and *Lecanium oleæ*, Bernard, from the castor-oil plant (*Ricinus*),—or castor bean, as he calls it. *Aspidiotus rossi*, Maskell, has been found on *Ricinocarpus*.[5] The very doubtful *Brachyscelis* (?) *beyeriæ*, Tepper, is from *Beyeria opaca*, F. Mueller, in Australia.[6]

[1] Cockerell, Psyche Supp., 1896, p. 21.
[2] Ann. Mag. Nat. Hist., 1894, p. 15.
[3] Cockerell, Trans. Ent. Soc. Lond., 1893, p. 162; Trans. Amer. Ent. Soc., 1893, p. 55.
[4] Cockerell, Trans. Amer. Ent. Soc., 1893, p. 50; Bull. Bot. Dept., Jamaica, August, 1893, p. 2.
[5] Maskell, Tr. N. Z. Inst., XXIV, p. 12; XXIII, p. 7.
[6] Tepper, Trans. Roy. Soc., South Australia, XVII, p. 276.

The following are found on box (*Buxus sempervirens*):

(1) *Eriococcus buxi*, Signoret. Signoret, Essai sur les Cochenilles.
(2) *Lecanium hesperidum*, Linnæus. Maskell, Scale Ins. N. Z., p. 111.
(3) *Aspidiotus aurantii*, Maskell. Maskell, Tr. N. Z. Inst., XXV, p. 206.
(4) *A. hederæ*, Vallot. Signoret, Essai sur les Cochenilles.
(5) *Pinnaspis buxi*, Bouché. Signoret, Essai. Formerly placed in *Mytilaspis*.

Coccus oogenes, Anderson, occurred upon *Phyllanthus emblica*, Linnæus; *Llaveia axinus*, Llave, was found on *Jatropha curcas*, Linnæus; *Tachardia lacca*, Kerr, has been found on *Aleurites moluccana*. From *Croton* the following are known:

(1) *Tachardia lacca*, Kerr. On *C. draco*, Schlecht., a species of Mexican origin. Watt.Dict. Econ. Prod. India, II, p. 410.
(2) *Phenacoccus barberi*, Cockerell. Cockerell, Ann. Mag. Nat. Hist., 1895, p. 61.
(3) *Dactylopius virgatus*, Cockerell, var. *farinosus*, Cockerell. Cockerell, Can. Ent., 1895, p. 259.
(4) *D. ceriferus*, Newstead. Newstead, Ind. Mus. Notes, III, No. 5, pp. 4, 5.
(5) *D. citri*, Boisduval. Cockerell, Bull. Bot. Dept. Jamaica, Aug. 1893, p. 3.
(6) *Lichtensia lutea*, Cockerell. At Vera Cruz. Cockerell, Ann. Mag. Nat. Hist., 1893, p. 51.
(7) *Diaspis pinnulifera*, Maskell. Maskell, Tr. N. Z., Inst., XXV, p. 208.
(8) *Mytilaspis citricola*, Packard. Maskell, Tr. N. Z. Inst., XXVII, p. 48. I doubt if this is the real *citricola*.
(9) *M. crotonis*, Cockerell. In Jamaica. Cockerell, Journ. Inst. Jamaica, 1893, p. 256.
(10) *Parlatoria pergandei*, Comstock, var. *crotonis*. Cockerell, Ann. Mag. Nat. Hist., 1895, p. 62.

Pseudoparlatoria ostreata, Cockerell, is destructive to *Acalypha marginata*, Spreng.[1] *Dactylopius virgatus*, Cockerell, occurs upon *Acalypha*.[2] *Ceroplastes albolineatus*, Cockerell, was found on *Excoecaria bicolor*, Hasskarl, a native of the Malay region, cultivated in Jamaica.[3]

URTICACEÆ.

The following are known from *Ulmus*:

(1) *Gossyparia ulmi*, Geoffroy. On *U. campestris*. Signoret, Essai, and most other authors.
(2) *Lecanium ulmi*, Linnæus. Signoret, Essai. On *U. campestris*.
(3) *L. caryæ*, Fitch, var. *canadense*, Cockerell. On *U. racemosa*. Cockerell, Can. Ent., 1895, p. 254.
(4) *L. pruinosum*, Coquillett. On cork elm. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 33.
(5) *Pulvinaria innumerabilis*, Rathvon. On *U. Americana* and *U. fulva*. Mundt, Can. Ent., 1884, p. 240.
(6) *Mytilaspis pomorum*, Bouché (including *conchiformis*). On *U. campestris*. Comstock, 2d Cornell Rept., p. 140; Signoret, Essai sur les Cochenilles.
(7) *Chionaspis americana*, Johnson. On *U. americana*. Champaign, Illinois (W. G. Johnson).

[1] Cockerell, Journ. Inst. Jamaica, 1892, p. 136; Insect Life, VI, p. 103.
[2] Cockerell, Bull. Bot. Dept. Jamaica, August, 1893, p. 3.
[3] Townsend, Journ. Inst. Jamaica, 1895, p. 169.

(8) *C. furfurus*, Fitch, var. *ulmi*.[1] On elm, Brownsville, Texas (C. H. T. Townsend).
(9) *Aspidiotus* near *perniciosus*, Comstock. Brownsville, Texas, found by Professor C. H. T. Townsend, on ash. The specimens are so parasitized that their identification becomes difficult.
(10) *A. ulmi*, Johnson. On *U. americana*. W. G. Johnson, Ent. News, 1896, p. 152.

Comstock records *Mytilaspis pomorum*, Bouché, from *Planera*. From hackberry (*Celtis*) the same author reports *M. pomorum*, Bouché, and *Aspidiotus ancylus*, Putnam. From *Celtis occidentalis* are known *Pulvinaria innumerabilis*, Rathvon[2] and *Lecaniodiaspis celtidis*, Cockerell[3] *Tachardia lacca*, Kerr, is found on *Celtis tetrandra* (syn. *roxburghii*). Coquillett records *Icerya purchasi*, Maskell, from *Humulus*. On the osage orange are found *Pulvinaria macluræ*, Fitch, and *Aspidiotus ancylus*, Putnam, the latter on Comstock's authority. The *P. macluræ* is frequently called *P. innumerabilis*, but see Cockerell.[4] There is also on osage orange a species of *Eulecanium*.[5]

The following are found on mulberry (*Morus*):

(1) *Dactylopius bromeliæ*, Bouché. Maskell, Tr. N. Z. Inst., XXVI, p. 89.
(2) *Lecanium mori*, Signoret. On *M. alba*. Signoret, Essai.
(3) *L. ribis*, Fitch. Cockerell, Can. Ent., 1895, p. 255.
(4) *Pulvinaria innumerabilis*, Rathvon. On *M. rubra*. Mundt, Can. Ent., 1884, p. 240.
(5) *P. japonica*, Cockerell. In Japan. Cockerell, Psyche Supp., February, 1896, p. 20.
(6) *Diaspis patelliformis*, Sasaki. In Japan.
(7) *D. pentagona*, Targioni-Tozzetti. In Italy

On *Ficus* are found many species, as follows:

(1) *Icerya purchasi*, Maskell. Recorded by Coquillett.
(2) *I. ægyptiacum*, Douglas. Insect Life, 1890, p. 105.
(3) *Tachardia lacca*, Kerr. On eight species of *Ficus*, including *F. religiosa*, Linnæus (Watt). On *F. indica*, Linnæus, and *F. religiosa* (Signoret).
(4) *Dactylopius longispinus*, Targioni-Tozzetti (*longifilis*). Cockerell, Ent., 1893, p. 266.

[1] New variety *ulmi*. Female: Scale white, about 2½ mm. long, moderately broad, exuviæ yellowish brown. Male: Scale very small, obscurely tricarinate, exuvium pale yellowish. Female brown: Five groups of ventral glands, median 18, cephalolaterals 15, caudolaterals 16; median lobes contiguous, rounded at ends, obliquely truncate at sides, not notched. Second lobes much smaller, consisting of a larger notched portion, and beyond that a small separated portion, and between these a spine. Third lobes small and nearly obsolete. A spine laterad of each median lobe. A long spine-like plate laterad of third lobe, beyond which, at some little distance, is a notch, followed by a sort of rudimentary broad crenate fourth lobe, and beyond this a spine and then two very large spine-like plates, not branched, and still further a group of about five large spine-like plates. Anal orifice between posterior ends of cephalolateral groups of glands, round, slightly broader than long. Perhaps a distinct species.

C. americana differs by having the median lobes trilobed, though rather obscurely, and very large spine-like plates branched at tips; there are also more glands in the caudolateral groups.

[2] Mundt, Can. Ent., 1884, p. 240.

[3] Cockerell, Psyche, Supp., February, 1896, p. 19.

[4] Science, August 11, 1893, p. 78.

[5] Cockerell, Insect Life, VII, p. 209; Can. Ent., 1895, p. 257.

(5) *D. ficus*, Signoret. On *F. carica*. Signoret, Essai sur les Cochenilles.
(6) *Ceroplastes rusci*, Linnæus. On *F. carica*. Signoret, Essai sur les Cochenilles.
(7) *C. floridensis*, Comstock. Cockerell, Journ. Inst. Jamaica, 1892, p. 54.
(8) *C. rubens*, Maskell. On *F.*, perhaps *macrophylla*, Desfontaines. Maskell, Tr. N. Z. Inst., XXV, p. 215.
(9) *Lecanium depressum*, Targioni-Tozzetti. On *F. martinicensis* (? = *laurifolia*) and *F. elastica* (Signoret).
(10) *L. oleæ*, Bernard. On *F. macrophylla* (Coquillett). On *F. carica* (Cockerell, Trans. Amer. Ent. Soc., 1893, p. 55).
(11) *L. hesperidum*, Linnæus. On *F. macrophylla* and on fig (Coquillett.) On *F. elastica* (Gillette and Baker).
(12) *L. longulum*, Douglas. On rubber tree. Gillette and Baker, Hemip. Colo., p. 127.
(13) *Coccus erion*, Anderson. On *F. indica*. An unrecognizable species.
(14) *Aspidiotus personatus*, Comstock. On *F.* near *benjamina*. Cockerell, Amer. Nat., 1895, p. 726.
(15) *A. rapax*, Comstock (*camelliæ*). On *F. elastica* (Gillette and Baker). Comstock, 2d Cornell Rept., p. 139.
(16) *A. ficus*, Ashmead. Cockerell, Journ. Inst. Jamaica, 1892, p. 54.
(17) *A. articulatus*, Morgan. Cockerell, Journ. Inst. Jamaica, 1892, p. 54.
(18) *A. cyanophylli*, Signoret. Comstock, 2d Cornell Rept., p. 139. On *F. indica* and *F. laurifolia*, Lam.
(19) *Mytilaspis ficus*, Signoret. Signoret, Essai sur les Cochenilles.
(20) *Chionaspis biclavis*, Comstock. Comstock, 2d Cornell Rept. On *F. laurifolia*.

Asterolecanium pustulans, Cockerell, occurs upon *Castilloa*.[1]

Aspidiotus articulatus, Morgan, *A. personatus*, Comstock, and *A. ficus*, Ashmead, are found upon *Artocarpus incisa* in Jamaica.[2] Lounsbury records *Orthezia insignis*, Douglas, from *Pilea*.

PLATANACEÆ.

Phenacoccus platani, Signoret, is from *Platanus orientalis*, Linnæus. Coquillett records *Lecanium hibernaculorum*, Boisduval, from *P. racemosa*, Nuttall.

JUGLANDACEÆ.

The following are known from *Juglans:*

(1) *Pulvinaria innumerabilis*, Rathvon. On *J. cinerea* and *J. nigra*. Mundt, Can. Ent., 1894, p. 240.
(2) *Lecanium pruinosum*, Coquillett. Coquillett, Insect Life, III, p. 384. On English walnut.
(3) *L. juglandis* (syn. *juglandifex*). On *J. cinerea* and *J. regia*. Signoret, Essai; Cockerell, Ent., 1894, p. 335.
(4) *Mytilaspis juglandis*, Bouché. Comstock, 2d Cornell Rept., p. 140. Hardly or not separable from *M. pomorum*.
(5) *Aspidiotus rapax*, Comstock. On *Juglans californica* (Coquillett). Coquillett also reports *A. convexus*, from walnut.
(6) *A. juglans-regiæ*, Comstock. On English walnut. Comstock, 2d Cornell Rept., p. 61.
(7) *A. juglandis*, Colvée. Described by Colvée in 1881; perhaps not distinct from the last.

[1] Cockerell, Sci. Gossip, 1893, p. 78.
[2] Cockerell, Insect Life, 1893, p. 159.

(8) *A. perniciosus*, Comstock. On English walnut. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 21.

(9) *A. aurantii*, Maskell. On English walnut. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 15.

Lecanium caryæ, Fitch, was found on *Hicoria ovata* (*Carya alba*).

MYRICACEÆ.

Ceroplastes myricæ, Linnæus, is from the South African *Myrica quercifolia*, Linnæus. Both plant and insect are doubtful species. Maskell reports *Ceroplastes ceriferus*, Anderson, and *Tachardia decorella*, Maskell, from *Myrica cerifera*, Linnæus, a native of North America.[1]

FAGACEÆ.

On the birches (*Betula*) are found:

(1) *Pulvinaria betulæ*, Linnæus. On *B. alba*. Signoret Essai, sur les Cochenilles.

(2) *Lecanium douglasi* of Sulc. On *B. alba* in Bohemia. Ent. Mo. Mag., 1895, p. 37.

(3) *L. pruinosum*, Coquillett. Coquillett, Insect Life, III, p. 384.

(4) *Aspidiotus betulæ*, Baerensprung. On *B. alba*. Signoret, Essai sur les Cochenilles. My specimens are from *B. alba* at Chuchle, near Prague, collected by Mr. Karel Sulc.

(5) *A. rapax*, Comstock. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 25.

(6) *Mytilaspis pomorum*, Bouché. Country Gentleman, January 10, 1895, p. 27.

(7) *Chionaspis lintneri*, Comstock. On *B. papyrifera*. Prince Edward Island (Fletcher).

On the alders (*Alnus*) are:

(1) *Chionaspis lintneri*, Comstock. Comstock, 2d Cornell Rept., p. 139.

(2) *C. alni*, Signoret. On *A. glutinosa* (syn. *communis*). Signoret, Essai sur les Cochenilles.

(3) *Lecanium gibber*, Dalman. Signoret, Essai sur les Cochenilles. This is probably *L. capreæ*, Linnæus.

On *Carpinus* are found:

(1) *Pulvinaria carpini*, Linnæus. Signoret, Essai sur les Cochenilles. Said to be on *C. staechas*, but no such name is in Index Kewensis.

(2) *Lecanium ribis*, Fitch. Cockerell, Amer. Nat., 1895, p. 731. Also on *Ostrya*.

Lecanium quercitronis, Fitch, occurs on ironwood.[2]

Lecanium coryli, Linnæus, is from *Corylus avellana; L. corylifex*, Fitch, is also from the hazel. The two are perhaps identical.

The following are found on various oaks (*Quercus*):

(1) *Asterolecanium quercicola*, Bouché. On white oak. Comstock, 2d Cornell Rept., p. 130. On *Q. robur*. Signoret, Essai. Also reported on *Q. ilex*, but in error for the following.

(2) *A. ilicicola*, Targioni-Tozzetti. On *Q. ilex*. Bull. Soc. Ent. Ital., 1892, p. 311.

(3) *Lecaniodiaspis quercus*, Cockerell. In Japan. Cockerell, Psyche Supp., 1896, p. 19.

(4) *Icerya purchasi*, Maskell. A few on *Q. douglasii* (Coquillett).

(5) *Phenacoccus quercus*, Douglas. See Ent. Mo. Mag., 1890, p. 155.

[1] Tr. N. Z. Inst., XXV, pp. 216, 249.

[2] Cockerell, Can. Ent., 1895, p. 255.

(6) *Nidularia pulvinata*, Planchon. On *Q. ilex*. Signoret, Essai sur les Cochenilles.
(7) *Gossyparia gramuntii*, Signoret. On *Q. ilex*. Signoret, Essai sur les Cochenilles.
(8) *Cerococcus quercus*, Comstock. On white oak. Comstock, 2d Cornell Rept., p. 140.
(9) *C. ehrhorni*, Cockerell. Cockerell, Psyche, 1895. On live oak in California.
(10) *Eriococcus quercus*, Comstock (*Rhizococcus quercus*). Comstock, 2d Cornell Rept., p. 140.
(11) *Kermes galliformis*, Riley. On white oak. Comstock, 2d Cornell Rept., p. 140. On *Q. undulata*. Gillette and Baker, Hemip. Colo., p. 126.
(12) *K. gillettei*, Cockerell. On *Q. undulata* in Colorado. Gillette and Baker, Hemip. Colo., p. 126. I found this species at Monument Rock, Santa Fe Canyon, New Mexico, 8,000 feet, August 11, 1895.
(13) *K. ballotæ*, Signoret. On *Q. ballota*. Signoret, Essai sur les Cochenilles.
(14) *K. bauhinii*, Planchon. On *Q. coccifera* and *Q. ilex*. Signoret, Essai sur les Cochenilles.
(15) *K. vermilio*, Planchon. On *Q. coccifera*. Signoret, Essai sur les Cochenilles.
(16) *K. gibbosus*, Signoret. On *Q. pedunculata*. Signoret, Essai sur les Cochenilles.
(17) *K. pallidus*, Signoret. On *Q. pedunculata* (=*robur* subsp.). Signoret, Essai sur les Cochenilles.
(18) *K. reniformis*, Signoret. On *Q. pedunculata*. Signoret, Essai sur les Cochenilles.
(19) *K. variegatus*, Gmelin. Signoret, Essai sur les Cochenilles.
(20) *K. quercus*, Newstead. I have seen no description of this.
(21) *Physokermes hemicryphus*, Dalman. On *Q. robur*. Signoret, Essai sur les Cochenilles. This is now considered a synonym of *P. abietis*, Modeer.
(22) *Lecanium emerici*, Planchon. On *Q. coccifera* and *Q. ilex*. Signoret, Essai sur les Cochenilles.
(23) *L. fuscum*, Gmelin. On *Q. robur*. Signoret, Essai sur les Cochenilles.
(24) *L. quercus*, Linnæus. On *Q. pedunculata*. Signoret, Essai sur les Cochenilles.
(25) *L. antennatum*, Signoret. On white oak. Comstock, 2d Cornell Rept., p. 140.
(26) *L. quercifex*, Fitch. On white oak. Comstock, 2d Cornell Rept., p. 140.
(27) *L. quercitronis*, Fitch. On black oak. Comstock, 2d Cornell Rept., p. 140. On *Q. undulata* in Colorado a variety is found. See Cockerell, Can. Ent., 1895, p. 255.
(28) *L. ciliatum*, Douglas. England. Ent. Mo. Mag., 1891, p. 67.
(29) *L. gigas*, Bremi. Supposed by Signoret to be a *Kermes*.
(30) *Pulvinaria innumerabilis*, Rathvon. Riley, Rept. Dept. Agric. for 1884.
(31) *Aspidiotus ancylus*, Putnam. Comstock, 2d Cornell Rept., p. 140.
(32) *A. obscurus*, Comstock. On willow oak. Comstock, 2d Cornell Rept., p. 140. Mr. A. L. Quaintance finds *A. obscurus* at Lake City, Florida, very abundant on *Q. aquatica* and *Q. catesbæi*.
(33) *A. nerii*, Bouché. On *Q. agrifolia*. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 20.
(34) *A. ilicis*, Signoret. On *Q. ilex*. Comstock, 2d Cornell Rept., p. 140.
(35) *A. zonatus*, Frauenfeld (syn. *quercus*). On *Q. montana*. Comstock, 2d Cornell Rept., p. 140. Also on *Q. robur*.
(36) *Chionaspis quercus*, Comstock. On *Q. lobata*. Comstock, 2d Cornell Rept., p. 140.
(37) *C. planchonii*, Signoret. On *Q. ilex*. Comstock, 2d Cornell Rept., p. 140.
(38) *Pseudopulvinaria sikkimensis*, Atkinson, 1889. See Insect Life, II, p. 55. Sikkim. Also on *Castanea*.
(39) *Aspidiotus* (*Aspidites*) *minimus*, Leonardi. On leaves of *Q. ilex*.

The following occur on the species of beech (*Fagus*):

(A) On sect. *Eufagus;* boreal.
(1) *Pulvinaria innumerabilis*, Rathvon. Riley, Rept. Dept. Agric. for 1884.

(2) *P. fagi*, Hardy, 1864 (as *Coccus*). British. Very doubtful. Walker has also named a *Coccus fagi*, "flava, elliptica, albofarinosa; length, 2 lines." This is evidently something different.

(3) *Lecanium oleæ*, Bernard. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 28.

(4) *Aspidiotus ancylus*, Putnam. Comstock, 2d Cornell Rept., p. 139.

(B) On sect. *Nothofagus;* austral.

(1) *Cœlostoma pilosum*, Maskell. Maskell, Tr. N. Z. Inst., XXIII, p. 30.

(2) *C. assimile*, Maskell. On *F. fusca*, J. D. Hooker, and *F. menziesii*, J. D. Hooker. Maskell, Tr. N. Z. Inst., XXII, p. 153; XXIII, p. 31.

(3) *Palæococcus zealandicus*, Maskell (*Leachia*, olim). Maskell, Tr. N. Z. Inst., XXIII, p. 27.

(4) *Solenophora fagi*, Maskell. Maskell, Tr. N. Z. Inst., XXII, p. 141.

(5) *Rhizococcus pulchellus*, Maskell. On *F. cliffortioides*, J. D. Hooker, *F. fusca* and *F. menziesii*. Maskell, Tr. N. Z. Inst., XXII, p. 144.

(6) *R. maculatus*, Maskell. On *F. cliffortioides*. Maskell, Tr. N. Z. Inst., XXII, p. 145.

(7) *R. intermedius*, Maskell. On *F. menziesii*. Maskell, Tr. N. Z. Inst., XXIII, p. 19.

(8) *R. totaræ*, Maskell. On *F. menziesii*. Maskell, Tr. N. Z. Inst., XXII, p. 142.

(9) *Eriococcus fagicorticis*, Maskell. On *F. fusca*. Maskell, Tr. N. Z. Inst., XXIV, p. 27.

(10) *E. pallidus*, Maskell. On *F. menziesii*. Maskell, Tr. N. Z. Inst., XXIII, p. 21.

(11) *E. raithbyi*, Maskell. On *F. menziesii*. Maskell, Tr. N. Z. Inst., XXII, p. 146.

(12) *Gossyparia cavellii*, Maskell. On *F. menziesii*. Maskell, Tr. N. Z. Inst., XXII, p. 148.

(13) *Ripersia fagi*, Maskell. On *F. menziesii*. Maskell. Tr. N. Z. Inst., XXIII, p. 24.

(14) *Dactylopius iceryoides*, Maskell. On *F. fusca*. Maskell, Tr. N. Z. Inst., XXIV, p. 34.

(15) *D. obtectus*, Maskell. On *F. fusca*. Maskell, Tr. N. Z. Inst., XXII, p. 153.

(16) *Lecanium* new species. Maskell, Tr. N. Z. Inst., XXII, p. 149. A blue species on *F. cliffortioides*.

(17) *Inglisia fagi*, Maskell. Maskell, Tr. N. Z. Inst., XXIII, p. 14.

SALICINEÆ.

On the willows (*Salix*) are found:

(1) *Pulvinaria salicis*, Bouché. Signoret, Essai; Comstock, 2d Cornell Rept., p. 140. On *S. viminalis*.

(2) *P. innumerabilis*, Rathvon. Riley, Rept. Dept. Agric. for 1884.

(3) *Coccus cryptus*, Kawall. On *S. acutifolia*. Kawall, Stett. Ent. Zeit., 1867, p. 122. A doubtful species.

(4) *C. hordeolum*, Dalman. Signoret suggests that this may have been founded on *Lecanium capreæ*, male, and *Chionaspis salicis*.

(5) *Lecanium hesperidum*, Linnæus. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 26.

(6) *L. capreæ*, Linnæus. On *S. alba*. Douglas, Ent. Mo. Mag., 1892, p. 279.

(7) *Mytilaspis saliceti*, Schrank. Probably identical with *pomorum*, Bouché. See Morgan, Ent. Mo. Mag., 1890, p. 228. On *S. holosericea*.

(8) *M. pomorum*, Bouché. Comstock, 2d Cornell Rept., p. 140. Country Gentleman, January 10, 1895, p. 27.

(9) *Aspidiotus niger*, Signoret. On *S. alba*. Signoret, Essai sur les Cochenilles.

(10) *A. convexus*, Comstock. Comstock, 2d Cornell Rept., p. 140.

(11) *A. rapax*, Comstock. Comstock, 2d Cornell Rept., p. 140. See also Maskell, Scale Ins. N. Z., p. 114 (as *camelliæ*).

(12) *Chionaspis salicis*, Linnæus. On *S. viminalis* and *S. alba* (Signoret).

(13) *C. ortholobis*, Comstock. Comstock, 2d Cornell Rept., p. 140; Cockerell, Can. Ent., 1894, p. 189.

(14) *C. salicis-nigræ*, Walsh. See Cockerell in Gillette and Baker, Hemip. Colo., p. 129.

On the poplars and cottonwoods (*Populus*) are:

(1) *Icerya purchasi*, Maskell. Coquillett, Rept. Dept. Agric. for 1888.

(2) *Lecanium capreæ*, Linnæus. On *P. virginiana*. Signoret, Essai sur les Cochenilles.

(3) *L. vagabundum*. Signoret, Essai. A very doubtful species of Kaltenbach.

(4) *L. hesperidum*, Linnæus. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 26. On Lombardy poplar.

(5) *L. oleæ*, Bernard. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 26. On Lombardy poplar.

(6) *Pulvinaria innumerabilis*, Rathvon. On *P. balsamifera*. Mundt, Can. Ent., 1884, p. 240.

(7) *P. tremulæ*, Signoret. On *P. tremula*, Linnæus. Signoret, Essai sur les Cochenilles.

(8) *P. populi*, Signoret. On *P. nigra*, Linnæus. Signoret, Essai sur les Cochenilles.

(9) *Aspidiotus convexus*, Comstock. Comstock, 2d Cornell Rept. Coquillett reports it on cottonwood and Lombardy poplar.

(10) *A. rapax*, Comstock. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 25. On cottonwood.

(11) *A. spurcatus*, Signoret. On *P. virginiana* and *P. pyramidalis*. Signoret, Essai sur les Cochenilles.

(12) *Chionaspis ortholobis*, Comstock, var. Cockerell, Can. Ent., 1894, p, 189; Gillette and Baker, Hemip. Colo., p. 129. An undescribed *Chionaspis* is also mentioned by Cockerell, Can. Ent., 1894, p. 190.

(13) *C. populi*, Baerensprung. On *P. nigra* and *P. pyramidalis*. Signoret, Essai sur les Cochenilles.

(14) *Mytilaspis pomorum*, Bouché. Country Gentleman, January 10, 1895, p. 27.

CASUARINACEÆ.

In the Australian region, where it is native, the genus *Casuarina* supports many Coccidæ, as follows:

(A) On *C. suberosa*. Native of Australia.

(1) *Rhizococcus casuarinæ*, Maskell. Maskell, Tr. N. Z. Inst., XXV, p. 231.

(B) On *C. stricta* (=*quadrivalvis*). Native of Australia.

(1) *Cylindrococcus amplior*, Maskell. Maskell, Tr. N. Z. Inst., XXV, p. 240.

(2) *Sphærococcus casuarinæ*, Maskell. Maskell, Tr. N. Z. Inst., XXIV, p. 40.

(3) *Frenchia casuarinæ*, Maskell. Maskell, Tr. N. Z. Inst., XXIV, p. 59.

(4) *Cylindrococcus spiniferus*, Maskell. Maskell, Tr. N. Z. Inst., XXIV, p. 44.

(5) *Cylindrococcus casuarinæ*, Maskell. Maskell, Tr. N. Z. Inst., XXIV, p. 43.

(C) On *C. equisetifolia*. Native of Malaya and Pacific islands.

(1) *Aspidiotus casuarinæ*, Maskell. Maskell, Tr. N. Z. Inst., XXVI, p. 67.

(2) *Frenchia casuarinæ*, Maskell. Maskell, Tr. N. Z. Inst., XXIV, p. 59.

(D) On *Casuarina*, species uncertain.

(1) *Gossyparia casuarinæ*, Maskell. Maskell, Tr. N. Z. Inst., XXV, p. 227.

(2) *Phenacoccus casuarinæ*, Maskell. Maskell, Tr. N. Z. Inst., XXV, p. 235. (As *Pseudococcus*.)

(3) *Eriococcus turgipes*, Maskell. Maskell, Tr. N. Z. Inst., XXV, p. 228.

(4) *Eriococcus conspersus*, Maskell. Maskell, Tr. N. Z. Inst., XXV, p. 230.

(5) *Rhizococcus pustulatus*, Maskell. Maskell, Tr. N. Z. Inst., XXV, p. 231.

(6) *Crocidocysta froggatti*, Rübsaamen. Rübsaamen, Berl. Ent. Zeit., XXXIX (1894), p. 219. Maskell says this is a *Cylindrococcus*.
(7) *Frenchia semioccultа*, Maskell. Maskell, Tr. N. Z. Inst., XXVII, p. 72.
(8) *Lecanium*, sp. Maskell, Tr. N. Z. Inst., XXVI, p. 72.
(9) *Mytilaspis casuarinæ*, Maskell. Maskell, Tr. N. Z. Inst., XXV, p. 209; XXVII, p. 45. Perhaps on *C. equisetifolia*.
(10) *Mytilaspis striata*, Maskell. Maskell, Tr. N. Z. Inst., XXVII, p. 47.
(11) *Aspidiotus eucalypti*, Maskell. Maskell, Tr. N. Z. Inst., XXV, p. 206.

In Jamaica I never could find any Coccidæ on the cultivated *Casuarina*, but *Aspidiotus rapax*, Comstock, occurs on it in Antigua.[1]

CONIFERÆ.

I. CUPRESSINEÆ.

Pulvinaria maskelli, Olliff, var. *spinosior*, Maskell, is found on *Frenela* or *Callitris robusta*.[2]

On *Thuya* (arbor-vitæ) are the following:

(1) *Aspidiotus nerii*, Bouché. On the cones of *T. occidentalis*. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 20.
(2) *Diaspis carueli*, Targioni-Tozzetti. Comstock, 2d Cornell Rept., p. 96. On *T. occidentalis*.
(3) *D. minima*, Targioni-Tozzetti. Comstock, 2d Cornell Rept., p. 96; Signoret, Essai sur les Cochenilles. On *T. occidentalis*.
(4) *Dactylopius ryani*, Coquillett. Coquillett, West Amer. Sci., 1889, p. 122. On *T. orientalis*.
(5) *Lecanium fletcheri*, Cockerell. In Canada.

Comstock[3] reports *Diaspis carueli*, Targioni-Tozzetti, from "*Biola orientalis;*" this should be *Thuya* (*Biota*) *orientalis*.

Maskell records *Icerya purchasi*, Maskell, from cypress; and *Leachia zealandica*, Maskell, from *Cupressus dacrydioides*. This latter name is not in the Index Kewensis. *Dactylopius ryani*, Coquillett, occurs on *Cupressus macrocarpa*.

The following are found on *Juniperus* (Juniper):

(1) *Diaspis carueli*, Targioni-Tozzetti. Signoret, Essai. On *J. communis*. Comstock reports it from *J. chinensis*, Linnæus, *J. rigida*, Sieber and Zuccarini, *J. oxycedrus*, Linnæus, *J. japonica* (=syn. of *chinensis*), *J. communis*, Linnæus, and "*J. reresii*" (perhaps meant for *recvesiana*, which is *chinensis*).
(2) *Diaspis juniperi*, Bouché. Signoret, Essai. On *J. communis*.
(3) *Lecanium oleæ*, Bernard. On Irish Juniper. Coquillett Bull. 26, Div. Ent., U. S. Dept. Agric., p. 28.
(4) *Lecanium fletcheri*, Cockerell. Pettit, Bull. 97, Cornell Univ. Exp. Sta., p. 341.

II. TAXEÆ.

On the New Zealand *Phyllocladus trichomanoides*, D. Don, Maskell records *Eriococcus phyllocladi*, Maskell,[4] and *Cœlostoma assimile*,

[1] Cockerell, Ann. Mag. Nat. Hist., 1895, p. 62.
[2] Maskell, Tr. N. Z. Inst., XXVI, p. 78.
[3] Rept. Dept. Agric. for 1880, p. 311.
[4] Tr. N. Z. Inst., XXIV, p. 25.

Maskell.[1] *Ctenochiton dacrydii*, Maskell, occurs on the New Zealand *Dacrydium cupressinum*.[2]

III. PODOCARPEÆ.

On the New Zealand *Podocarpus totara*, G. Benn., Maskell records:

(1) *Cœlostoma pilosum*, Maskell. Tr. N. Z. Inst., XXIII, p. 30.
(2) *Rhizococcus totaræ*, Maskell. Tr. N. Z. Inst., XXII, p. 142.
(3) *Leachia zealandica*, Maskell. Tr. N. Z. Inst., XXIII, p. 27.
(4) *Cœlostoma compressum*, Maskell. Tr. N. Z. Inst., XXIV, p. 46.

He also reports from *Podocarpus* sp. two Diaspinæ, *Aspidiotus aurantii*, Maskell,[3] and *Mytilaspis pallida*, Green, var.?[4]

IV. ARAUCARIEÆ.

The following have been found on *Araucaria:*

(1) *Dactylopius ryani*, Coquillett. On *A. excelsa* in California. Coquillett, West Amer. Sci., 1889, p. 122.
(2) *D. aurilanatus*, Maskell. On *A. bidwillii*, Hooker, and *A. excelsa*. Maskell, Tr. N. Z. Inst., XXII, p. 152.
(3) *Eriococcus araucariæ*, Maskell. Maskell, Scale Ins. N. Z., p. 111; Comstock, 2d Cornell Rept., p. 137 (as *Rhizococcus*).

V. ABIETINEÆ.

The Coccidæ of *Pinus* are:

(1) *Physokermes insignicola*, Craw. On *P. insignis*. Cockerell, Can. Ent., 1895, p. 258.
(2) *P. abietis*, Modeer (*Lecanium piceæ*). Signoret, Essai. Newstead cites it only from *Abies*. (Ent. Mo. Mag., 1893, p. 209.)
(3) *Icerya purchasi*, Maskell. Maskell, Scale Ins. N. Z., p. 113.
(4) *Puto antennata*, Signoret. On *P. cembra*, Linnæus. Signoret, Essai sur les Cochenilles.
(5) *Monophlebus hellenicus*, Gennadius. On *P. halepensis*, Miller. An orange species, 7 to 8 mm. long, legs and antennæ black.
(6) *Leucaspis signoretii*, Targioni-Tozzetti. On *P. sylvestris*, L. Signoret, Essai sur les Cochenilles.
(7) *L. pini*, Hartig. On *P. laricio*, Poirer. Signoret, Essai. According to Mr. Sulc the *Fiorinia sulci*, Newstead, formerly confounded with *L. pini*, is a distinct species, but nevertheless a *Leucaspis*.
(8) *Chionaspis pinifolii*, Fitch. On *P. monophylla*, etc. Comstock, 1880; Signoret, Essai sur les Cochenilles (as *Mytilaspis pinifoliæ*).
(9) *Mytilaspis newsteadi*, Sulc. On leaves of *P. sylvestris*. Bohemia. Female scale much like *pomorum*, but longer and with more parallel sides.
(10) *Aspidiotus abietis*, Schrank. On *P. sylvestris*. Cockerell, Can. Ent., 1894, p. 190.

Coquillett[5] records *Lecanium oleæ*, Bernard, from the cedar of Lebanon and from Indian cedar.

[1] Tr. N. Z. Inst., XXIII, p. 31.
[2] Tr. N. Z. Inst., XXIV, p. 18.
[3] Tr. N. Z. Inst., XXVII, p. 41.
[4] Tr. N. Z. Inst., XXVII, p. 46.
[5] Bull. 26., Div. Ent., Dep. Agric., p. 29 (1892).

On various firs and spruces are found:

(1) *Physokermes abietis*, Modeer. On *Abies excelsa* in Europe.
(2) *P. coloradensis*, Cockerell. On spruce. Manitou, Colorado. Gillette and Baker, Hemip. Colo., p. 126.
(3) *Icerya purchasi*, Maskell. Maskell, Scale Ins. N. Z., p. 113.
(4) *Coccus hystrix*, Baerensprung. Signoret, Essai. A problematical species.
(5) *Chionaspis pinifolii*, Fitch. Gillette and Baker, Hemip. Colo., p. 129; Comstock, 1880 Rept., p. 140.
(6) *Mytilaspis abietis*, Signoret. Comstock, 2d Cornell Rept., p. 140; Signoret, Essai sur les Cochenilles. On *Abies excelsa*.
(7) *Aspidiotus abietis*, Schrank. On *Abies canadensis*. Cockerell, Can. Ent., 1894, p. 190.
(8) *Syngenaspis parlatoriæ*, Sulc. On *Abies*. Bohemia (Sulc.)

CYCADACEÆ.

The following are found on *Cycas:*

(1) *Lecanium cycadis*, Boisduval. On *C. revoluta*. Signoret, Essai sur les Cochenilles.
(2) *L. oleæ*, Bernard. On *C. revoluta*. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 29.
(3) *L. hemisphæricum*, Targioni-Tozzetti. Cockerell, Bull. Bot. Dept., Jamaica, 1894, p. 71; Journ. Inst. Jamaica, 1893, p. 254.
(4) *Diaspis amygdali*, Tryon (*lanatus*). On *C. media*. Cockerell, Insect Life, V, p. 247.
(5) *Howardia elegans*, Leonardi. On *C. revoluta*, at Portici, Italy.
(6) *Ischnaspis filiformis*, Douglas. Cockerell, Can. Ent., 1895, p. 260. On *C. revoluta*.
(7) *Fiorinia camelliæ*, Comstock. Comstock, 2d Cornell Rept., p. 1392. On *C. revoluta*.
(8) *Poliaspis cycadis*, Comstock. Comstock, 2d Cornell Rept., p, 1392 On *C. revoluta*.
(9) *Aspidiotus cycadicola*, Boisduval. On *C. revoluta*. Signoret, Essai sur les Cochenilles.
(10) *A. dictyospermi*, Morgan, var. *Jamaicensis*, Cockerell. Cockerell, Can. Ent., 1894, p. 128.

C. revoluta is a Japanese species; *C. media* is Australian.

Olliff[1] refers to a coccid on *Macrozamia* attacked by *Thalpochares coccophaga;* but he alludes to the plant as a fern. Comstock[2] records *Parlatoria proteus*, Curtis, from *Microsamia*, but I suppose *Macrozamia* was intended.

"*Chermes*" *dionis* was from *Dion* (more properly *Dioon*) *edule*, and from the same plant Comstock reports *Poliaspis cycadis*, Comstock.

Dactylopius zamiæ, Lucas, is from *Zamia spiralis*.[3] *Diaspis zamiæ*, Morgan, was found on *Zamia*.[4]

ORCHIDACEÆ.

In the Gardeners' Chronicle[5] will be found an account of eighteen species of Coccidæ living on orchids. The following have been recorded

[1] Agric. Gaz. N. S. W., November, 1891, p. 668.
[2] 2d Cornell Rept., p. 114.
[3] Signoret, Essai sur les Cochenilles.
[4] Ent. Mo. Mag., 1890, p. 45.
[5] May 6, 1893, p. 548.

from orchids, genus not stated: *Aspidiotus epidendri*, Bouché, *A. nerii*, Bouché, and *Dactylopius glaucus*, Maskell;[1] *Lecanium hemisphæricum*, Targioni-Tozzetti, and *Aspidiotus ficus*, Ashmead;[2] *Aspidiotus biformis*, Cockerell,[3] and *Chionaspis braziliensis*, Signoret.[4]

The genera of orchids on which coccids have been found, and their coccids, are as follows:

(A) *Stelis*, Swartz.

(1) *Lecanium hesperidum*, Linnæus. Cockerell, Trans. Amer. Ent. Soc., 1893, p. 49.

(B) *Dendrobium*, Swartz.

(1) *Aulacaspis boisduralii*, Signoret. Maskell, Tr. N. Z. Inst., XXVII, p. 44 (as *Diaspis*).

(2) *Fiorinia stricta*, Maskell. Maskell, Scale Ins. N. Z., p. 112.

(3) *Ctenochiton elongatus*, Maskell. Maskell, Scale Ins. N. Z., p. 112.

(C) *Phaius*, Lour.

(1) *Lecanium hibernaculorum*, Boisduval. Signoret, Essai sur les Cochenilles.

(D) *Earina*, Lindley.

(1) *Ctenochiton elongatus*, Maskell. Maskell, Scale Ins. N. Z., p. 112.

(2) *Fiorinia stricta*, Maskell. Maskell, Scale Ins. N. Z., p. 112.

(E) *Epidendrum*, Linnæus.

(1) *Aspidiotus epidendri*. Signoret, Essai sur les Cochenilles. On *E. hanburii*, Lindley (a Mexican species), and others.

(2) "*Lecanium*" *epidendri*, Bouché. Signoret, Essai. On *E. ciliare* (syn. *cuspidatum*). This is probably identical with *Asterolecanium oncidii*, Cockerell.

(3) *Asterolecanium oncidii*, Cockerell. Cockerell, Bull. Bot. Dept. Jamaica, 1896, p. 8.

(F) *Cattleya*, Lindley.

(1) *Aulacaspis boisduvalii*, Signoret. Maskell, Tr. N. Z. Inst., XXVII, p. 44 (as *Diaspis*).

(2) *Aspidiotus biformis*, Cockerell, var. *cattleyæ*, Cockerell. On *C. bowringiana*, Veitch, a native of Honduras. Cockerell, Gard. Chron., May 6, 1893, p. 584.

(3) *Lecanium pseudhesperidum*, Cockerell. In a greenhouse at Ottawa, Canada.

(G) *Broughtonia*, Robert Brown.

(1) *Asterolecanium oncidii*, Cockerell. On *B. sanguinea*, a West Indian species. Cockerell, Sci. Goss., 1893, p. 78 (as *Planchonia*).

(2) *Vinsonia stellifera*, Westwood. On *B. sanguinea*. Cockerell, Bull. Bot. Dept. Jamaica, 1895, p. 101.

(3) *Aulacaspis boisduvalii*, Signoret. On *B. sanguinea*. Cockerell, Gard. Chron., May 6, 1893, p. 548.

(H) *Cymbidium*, Swartz.

(1) *Aulacaspis cymbidii*, Bouché. On *C. pendulum*, an East Indian species. Signoret, Essai (as *Diaspis*).

(2) *Mytilaspis pinnæformis*, Bouché. On *C. pendulum*. Signoret, Essai sur les Cochenilles.

(I) *Stanhopea*, Forster.

(1) *Vinsonia stellifera*, Westwood. Cockerell, Amer. Nat., 1895, p. 727; Hart, Bull. Misc. Inform., Bot. Gardens, Trinidad, April, 1895, p. 38.

(J) *Odontoglossum*, Humboldt, Bonpland and Kunth.

(1) *Aspidiotus biformis*, Cockerell, var. *odontoglossi*, Cockerell. On *O. grande*, Lindley, a native of Guatemala. Cockerell, Gard. Chron., May 6, 1893, p. 548.

(K) *Rodriguezia*, Ruiz and Pavon.

(1) *Conchaspis angræci*, Cockerell (= *Pseudinglisia rodriguezieæ*, Newstead). On *R. secunda*. Newstead, Ent. Mo. Mag., 1893, p. 154.

[1] Maskell, Scale Ins. N. Z., p. 113.

[2] Cockerell, Insect Life, VI, p. 103.

[3] Cockerell, Journ. Trinidad Field Nat. Club, 1894, p. 307.

[4] Maskell, Tr. N. Z. Inst., XXV, p. 211.

(L) *Oncidium*, Swartz.

(1) *Aspidiotus biformis*, Cockerell. On *O. spruceì*, Lindley, a native of Brazil. Cockerell, Gard. Chron., May 6, 1893, p. 548; Townsend, Journ. Inst. Jamaica, 1895, p. 169.

(2) *Aulacaspis boisduvalii*, Signoret. On *O. quadripetalum*, Swartz (syn., *tetrapetalum*), a native of Mexico. Cockerell, Gard. Chron., May 6, 1893, p. 548.

(3) *Asterolecanium oncidii*, Cockerell. Cockerell, Sci. Goss., 1893, p. 78 (as *Planchonia*). On *O. quadripetalum*. Targioni-Tozzetti, Bull. Soc. Ent. Ital., 1893, p. 311 (as *Asterolecanium aureum*).

(M) *Brassia*, Robert Brown.

(1) *Pulvinaria brassiæ*, Cockerell. On *B. verrucosa*, Bateman, a native of Mexico. Cockerell, Can. Ent., 1895, p. 135.

(N) *Vanda*, Robert Brown.

(1) *Parlatoria proteus*, Curtis. Signoret, Essai sur les Cochenilles.

(O) *Angræcum*, Thou.

(1) *Lecanium angræci*, Boisduval. Signoret, Essai. A problematical species. On *A. sesquipedale*, a native of Madagascar.

(2) *Conchaspis angræci*, Cockerell. On *A. sesquipedale* and *A. eburneum* var. *virens* (Lindley). Cockerell, Bull. Bot. Dept. Jamaica, February, 1893, p. 9; Journ. Inst. Jamaica, I, p. 373.

(3) *Asterolecanium aureum*, Boisduval. On *A. sesquipedale*. Cockerell, Journ. Inst. Jamaica, I, p. 373.

(P) *Selenipedium*, H. G. Reichenbach.

(1) *Parlatoria proteus*, Curtis. Signoret, Essai sur les Cochenilles.

SCITAMINACEÆ.

Curcuma longa, Linnæus, a native of tropical Asia, has been recorded as a food plant of *Aspidiotus ficus*, Ashmead.[1] *Calathea vittata* (syn. *Maranta vittata*) is the food plant of *Asterolecanium aureum*.

On *Musa* are found:

(1) *Aspidiotus palmæ*, Morgan and Cockerell. On banana. Cockerell, Insect Life, V, p. 245; Journ. Trinidad Club, 1894, p. 306.

(2) *A. destructor*, Signoret. On banana. Cockerell, Journ. Trinidad Club, 1894, p. 307.

(3) *A. articulatus*, Morgan. Cockerell, Insect Life, 1893, p. 160.

(4) *A. personatus*, Comstock. Cockerell, Insect Life, 1893, p. 160.

(5) *A. ficus*, Ashmead. Cockerell, Insect Life, 1893, p. 160.

From *Heliconia bihai*, Linnæus, a native of South America, is recorded *Pinnaspis pandani*, Comstock.[2] Comstock[3] records *Aulacaspis boisduvalii*, Signoret, from *Ravenala madagascariensis*.

BROMELIACEÆ.

The pineapple, *Ananas ananas* (Linnæus) = *sativus*, a native of tropical America, is not rarely attacked by *Diaspis bromeliæ*, Kerner, which is really an *Aulacaspis*. In Jamaica there is found upon it a small

[1] Townsend, Journ. Inst. Jamaica, 1895, p. 169.

[2] Cockerell, Journ. Trinidad Club, 1894, p. 307.

[3] 2d Cornell Rept., p. 86.

mealy bug, *Dactylopius brevipes*.[1] A different mealy bug, *D. bromeliæ*, Bouché, also occurs on pineapple; full particulars of it are given by Signoret, who received it from Zanzibar. There is also a problematical *Lecanium bromeliæ* on pineapple, said to resemble *L. hesperidum*, Linnæus, very much.

Aspidiotus vriesiæ. Signoret,[2] is from *Tillandsia* (*Vriesia*) *splendens*.

IRIDACEÆ.

Lecanium patersoniæ, Maskell, is from *Patersonia glabrata*, Robert Brown, a native of Australia.[3]

AMARYLLIDACEÆ.

Lecanium oleæ, Bernard, and *L. hesperidum*, Linnæus, have been found on *Hippeastrum equestre*, Herbert, a native of Mexico.[4] *Dactylopius liliacearum*, Bouché, occurs on *Crinum*;[5] it is also found on *Amaryllis*. *Lecanium assimile*, Newstead, var. *amaryllidis*, is from *Amaryllis*.[6] *Dactylopius liliacearum*, Bouché, is found on *Pancratium*. *D. simplex*, Cockerell, is from *Hymenocallis caribæa* (*Pancratium caribæum*).[7] *Asterolecanium aureum* was found by Mr. Hart on *Hippeastrum* in cultivation in Trinidad.

Gymnococcus agavium (Douglas) was found on *Agave*. *Aspidiotus bowreyi*, Cockerell, is from *Agave rigida*.[8] Coquillett[9] reports *Aspidiotus nerii*, Bouché, from *Agave americana*.

DIOSCOREACEÆ.

Aspidiotus hartii, Cockerell, occurs on yam.[10]

LILIACEÆ.

Following is a list of the genera infested, with their coccids:

(A) *Smilax*, Linnæus.

(1) *Aspidiotus smilacis*. Comstock. Comstock, 2d Cornell Rept.

(2) *Lecanium urichi*, Cockerell. On *S. campestris*, Grisebach, Rio Grande do Sul, Brazil (Von Ihering).

(B) *Rhipogonum*, Forster.

(1) *Chionaspis minor*, Maskell. On *R. scandens*. Maskell, Scale Ins. N. Z., p. 113.

[1] Cockerell, Ent., 1893, p. 267.

[2] Signoret, Essai sur les Cochenilles.

[3] Maskell, Tr. N. Z. Inst., XXVII, p. 58.

[4] Cockerell, Insect Life, V, p. 245; Bull. Bot. Dept., Jamaica, 1894, p. 18.

[5] Signoret, Essai sur les Cochenilles.

[6] Cockerell, Trans. Amer. Ent. Soc., 1893, p. 53.

[7] Cockerell, Ent., 1893, p. 267.

[8] Cockerell, Ent. News, 1894, p. 59.

[9] Bull. 26, Div. Ent., U. S. Dept. Agric., p. 20.

[10] Cockerell, Psyche Supp., 1895, p. 7.

(C) *Ruscus*, Linnæus.

(1) *Ceroplastes rusci*, Linnæus. Signoret, Essai. On *R. aculeatus*.

(2) *Aspidiotus affinis*, Targioni-Tozzetti. Signoret, Essai. On *R. aculeatus*.

(D) *Asparagus*, Linnæus.

(1) *Lecanium anthurii*, Boisduval. Maskell, Tr. N. Z. Inst., XXV, p. 219.

(2) *L. asparagi*, Giard, name only, 1893. On *A. horridus* in Algeria.

(3) *Diaspis asparagi*, Giard, name only, 1893. On *A. horridus* in Algeria.

(E) *Aspidistra*, Kerr.

(1) *Chionaspis aspidistræ*, Signoret. On *A. elatior*, Blume (syn. *variegata*), a native of Japan. Signoret, Essai.

(F) *Phormium*, Forster.

The following are all on *P. tenax*, Forster, the New Zealand flax:

(1) *Cœlostoma wairoense*, Maskell. Maskell, Scale Ins. N. Z., p. 113.

(2) *Dactylopius calceolariæ*, Maskell. Maskell, Scale Ins. N. Z., p. 113; also Tr. N. Z. Inst., XXII, p. 149.

(3) *Mytilaspis cordylinidis*, Maskell. Maskell, Scale Ins. N. Z., p. 113.

(4) *Fiorinia stricta*, Maskell. Maskell, Scale Ins. N. Z., p. 113.

(5) *Aspidiotus phormii*, De Brème. Signoret, Essai sur les Cochenilles.

(6) *A. sphærioides*, Cockerell. Cockerell, Psyche Supp., 1895, p. 7.

(7) *A. ficus*, Ashmead. Gillette and Baker, Hemip. Colo., p. 128.

(G) *Aloe*, Linnæus.

(1) *Aspidiotus aloes*, Boisduval. On *A. variegata*, Linnæus. Signoret, Essai. On *A. saponaria*, Haworth (=*A. umbellata*). Comstock, 2d Cornell Rept., p. 72. The plants are natives of South Africa.

(H) *Gasteria*, Duval.

(1) *Aspidiotus aloes*, Boisduval. On *G. disticha* (=*Aloe angulata*). Signoret, Essai sur les Cochenilles.

(I) *Yucca*, Linnæus.

(1) *Lecanium oleæ*, Bernard. In Chile. Cockerell, Can. Ent., 1895, p. 257.

(2) *Dactylopius olivaceus*, Cockerell. Cockerell, Psyche Supp., 1896, p. 18. Mexico.

(3) *Phenacoccus yuccæ*, Coquillett. Mexico and California.

(4) *Lecaniodiaspis yuccæ*, Townsend. New Mexico; Organ Mountains (Townsend).

(5) *Aspidiotus yuccæ*, Cockerell. Psyche Supp., 1896, p. 20. Mexico.

(6) *A. nerii*, Bouché. Comstock, 2d Cornell Rept., p. 140. Exogenetic.

(7) *Mytilaspis pomorum*, Bouché. Comstock, 2d Cornell Rept., p. 140. Exogenetic.

(J) *Dracæna*, Linnæus.

(1) *Pinnaspis pandani*, Comstock. Cockerell, Ent. Mo. Mag., 1893, p. 39 (as *Mytilaspis*).

(2) *Aspidiotus nerii*, Bouché. Gillette and Baker, Hemip. Colo., p. 128.

(K) *Cordyline*, Commerson.

(1) *Lecanium hemisphæricum*, Targioni-Tozzetti. Signoret, Essai. Recorded from *Dracæna australis*, which is a *Cordyline*.

(2) *Dactylopius calceolariæ*, Maskell. Maskell, Tr. N. Z. Inst., XXVI, p. 89. On the New Zealand *C. australis*.

(3) *Leucaspis cordylinidis*, Maskell. Maskell, Tr. N. Z. Inst., XXV, p. 210.

(4) *Fiorinia stricta*, Maskell. Maskell, Scale Ins. N. Z. On *C. australis* and *C. indivisa*.

(5) *Mytilaspis cordylinidis*, Maskell. Maskell, Scale Ins. N. Z. On *C. australis* and *C. indivisa*.

(L) *Astelia*, Banks and Solander.

The following are all on the New Zealand *A. cunninghamii*, Hooker:

(1) *Mytilaspis cordylinidis*, Maskell. Maskell, Scale Ins. N. Z., p. 111.

(2) *M. epiphytidis*, Maskell. Maskell, Scale Ins. N. Z., p. 111.

(3) *Fiorinia asteliæ*, Maskell. Maskell, Scale Ins. N. Z., p. 111.

(4) *F. stricta*, Maskell. Maskell, Scale Ins. N. Z., p. 111.

(5) *Phenacoccus asteliæ*, Maskell. Maskell, Scale Ins. N. Z., p. 111 (as *Pseudococcus*).

JUNCACEÆ.

Maskell[1] records *Aspidiotus cladii*, Maskell, from *Xerotes*, sp., and *Chionaspis xerotidis*, Maskell, from *Xerotes longifolia*. *Aspidiotus rossi*, Maskell, is found on *Xanthorrhœa*.[2] *Signoretia luzulæ*, Dufour, is found on *Luzula*.

PALMACEÆ.

The following are from various palms, genus not specified: *Dactylopius longispinus=longifilis*,[3] *D. glaucus*,[4] *Asterolecanium urichi*,[5] *Icerya montserratensis*,[6] *Lecanium hesperidum* and *L. hemisphæricum*,[3] *L. oleæ*,[7] *Fiorinia camelliæ*,[8] *Pinnaspis pandani*,[9] *Ischnaspis filiformis*,[10] *Parlatoria proteus*,[11] *Mytilaspis pallens* (apparently on a fan palm),[12] *Chionaspis minor*,[3] *Aspidiotus epidendri* and *A. nerii*,[4] *A. personatus*,[3] *A. articulatus*,[10] *A. palmarum*,[7] *A. dictyospermi*.[13]

The following genera have been recorded as supporting Coccidæ:

(A) *Areca*, Linnæus.

(1) *Lecanium hemisphæricum*, Targioni-Tozzetti. On *A. catechu*. Cockerell, Insect Life, 1893, p. 159.

(2) *Aspidiotus ficus*, Ashmead. On *A. catechu*. Cockerell, Insect Life, 1893, p. 159.

(3) *A. aurantii*, Maskell. On *A. catechu*. Cockerell, Insect Life, 1893, p. 159.

(4) *A. destructor*, Signoret. Cockerell, Journ. Inst. Jamaica, 1893, p. 255, (as *A. nerii*, var.).

(5) *Chionaspis aspidistræ*, Maskell. On *A. catechu*. Maskell, Tr. N. Z. Inst., XXIV, p. 15.

(6) *Ischnaspis filiformis*, Douglas. On *A. glandiformis*. Townsend, Journ. Inst. Jamaica, 1895, p. 169.

(B) *Rhopalostylis*, H. Wendland and Drude.

(1) *Dactylopius arecæ*, Maskell. On roots of *R. sapida* (syn., *Areca sapida*). Maskell, Tr. N. Z. Inst., XXII, p. 150.

(C) *Howea*, Beccari.

(1) *Fiorinia camelliæ*, Comstock. On *H.* (olim *Kentia*) *belmoreana*. Comstock, 2d Cornell Rept., p. 111.

(D) *Oreodoxa*, Willdenow.

(1) *Aspidiotus ficus*, Ashmead. On *O. regia*. Cockerell, Can. Ent., 1895, p. 261.

[1] Tr. N. Z. Inst., XXVII.
[2] Maskell, Tr. N. Z. Inst., XXV, p. 207.
[3] Cockerell, Insect Life, VI, p. 103.
[4] Maskell, Scale Ins. N. Z., p. 113.
[5] Cockerell, Journ. Trinidad Club, 1894, p. 308.
[6] Cockerell, Bull. Bot. Dept. Jamaica, August, 1893, p. 2.
[7] Comstock, 2d Cornell Rept., p. 140.
[8] Maskell, Tr. N. Z. Inst., XXV, p. 211.
[9] Cockerell, Journ. Trinidad Club, 1894, p. 306.
[10] Cockerell, Journ. Inst. Jamaica, 1892, p. 54.
[11] Cockerell, Journ. Inst. Jamaica, 1893, p. 256.
[12] Maskell, Tr. N. Z. Inst., XXII, p. 134.
[13] Cockerell, Amer. Nat., 1895, p. 728.

(E) *Caryota*, Linnæus.

(1) *Lecanium tessellatum*, Signoret. On *C.* "*ursus*," doubtless =*urens*. Signoret, Essai.

(2) *L. perforatum*, Newstead.

(F) *Nipa*, Thunberg.

(1) *Dactylopius nipæ*, Maskell. On *N. fruticans*, Thunberg, the only species, a native of the East Indies. Maskell, Tr. N. Z. Inst., XXV, p. 233.

(G) *Phytelephas*, Ruiz and Pavon.

(1) *Fiorinia pellucida*, Targioni-Tozzetti. On the South American *F. macrocarpa*, Ruiz and Pavon. Signoret, Essai.

(H) *Phœnix*, Linnæus.

The following are from the date palm, *P. dactylifera*, Linnæus, a native of North Africa and Arabia.

(1) *Aonidia blanchardi*, Targioni-Tozzetti. Mém. Soc. Zool. France, V (1892), p. 69.

(2) *Parlatoria victrix*, Cockerell.

(3) *Aspidiotus palmarum*, Bouché. Signoret, Essai. Comstock cites *A. destructor*.

(4) *A. aurantii*, Maskell. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 15. See also, Cockerell, Insect Life, V, p. 246.

(I) *Sabal*, Adans.

(1) *Aspidiotus sabalis*, Comstock. On palmetto. Comstock, 2d Cornell Rept., p. 67.

(2) *A. destructor*, Signoret. Cockerell, Journ. Inst. Jamaica, 1893, p. 255 (as *nerii* var.).

(3) *A. articulatus*, Morgan. On *S. umbraculifolia*. Cockerell, Insect Life, V, p. 246.

(4) *A. personatus*, Comstock. On *S. umbraculifolia*. Cockerell, Insect Life, V, p. 246.

(5) *Ischnaspis filiformis*, Douglas. In Antigua. Cockerell, Ent. Mo. Mag., 1893, p. 17.

(J) *Washingtonia*, H. Wendland. Coquillett (Bull. 26, Div. Ent., U. S. Dept. Agric., p. 15) reports *Aspidiotus aurantii*, Maskell, from the California Palm.

(K) *Chamærops*, Linnæus.

(1) *Aspidiotus chamæropsis*, Signoret (or *chamæropsidis*). On "*C. Australis*," a name not in Index Kewensis. Signoret, Essai.

(2) *A. palmarum*, Targioni-Tozzetti. Mém. Soc. Zool. France, V (1892), p. 81.

(3) *A. dictyospermi*, Morgan.

It may be added, that Gillette and Baker[1] record *A. dictyospermi* from "*Champæropsis elegans*." What this is, I do not know.

(L) *Livistona*, Robert Brown.

(1) *Fiorinia camelliæ*, Comstock. Maskell, Tr. N. Z. Inst., XXIV, p. 16.

(M) *Raphia*, Beauvois.

(1) *Lecanium perforatum*, Newstead. Gillette and Baker, Hemip. Colo., p. 128.

(N) *Cocos*, Linnæus.

The following are on the cocoanut, *C. nucifera*:

(1) *Dactylopius virgatus*, Cockerell. Bull. Bot. Dept. Jamaica, August, 1893, p. 3; Insect Life, VI, p. 103.

(2) *D. cocotis*, Maskell. Tr. N. Z. Inst., XXII, p. 149; and a variety, Maskell, Tr. N. Z. Inst., XXIV, p. 12. Fiji and Laccadive Islands.

(3) *Coccus crion*, Anderson, 1787. A problematical species, perhaps a *Dactylopius*.

(4) *Asterolecanium palmæ*, Cockerell. Sci. Goss., 1893, p. 77.

(5) *Vinsonia stellifera*, Westwood. Cockerell, Gard. Chron., May 6, 1893, p. 548.

(6) *Aulacaspis boisduvalii*, Signoret. Cockerell, Journ. Inst. Jamaica, 1893, p. 180. Mr. Morgan's *A. tentaculatus* appears to me to be the same species.

(7) *Chionaspis vandalicus*, Cockerell. A problematical species. See Cockerell, Journ. Inst. Jamaica, 1892, p. 54.

[1] Hemip. Colo., p. 128.

(8) *C. minor*, Maskell. Cockerell, Ent. Mo. Mag., 1893, p. 38.
(9) *Pinnaspis pandani*, Comstock. Cockerell, Insect Life, VI, p. 103; Ent. Mo. Mag., 1893, p. 38 (as *Mytilaspis buxi*).
(10) *Fiorinia fioriniæ*, Targioni-Tozzetti (or *camelliæ*). Cockerell, Ent. Mo. Mag., 1893, pp. 38–40; Journ. Inst. Jamaica, 1892, p. 54.
(11) *Aspidiotus palmæ*, Cockerell. Ent. Mo. Mag., 1893, pp. 38–40; Journ. Inst. Jamaica, 1892, p. 54 (as *rapax* var.).
(12) *A. destructor*, Signoret. Cockerell, Journ. Inst. Jamaica, 1893, p. 255 (as *palmarum*); Journ. Trinidad Club, 1894, p. 307; Maskell, Tr. N. Z. Inst., XXIV, p. 12; Comstock, 2d Cornell Rept., p. 75 (in Bourbon).
(13) *A. ficus*, Ashmead. Cockerell, Can. Ent., 1895, p. 261; Ent. Mo. Mag., 1893, pp. 38–40.
(14) *A. articulatus*, Morgan. Cockerell, Ent. Mo. Mag., 1893, pp. 38–40.
(15) *A. punicæ*, Cockerell. Cockerell, Journ. Inst. Jamaica, 1893, p. 255.
(O) *Latania*, Commerson.
(1) *Aspidiotus lataniæ*, Signoret. On *L. aurea*, Duncau (syn. *verschaffeltii*), a native of Rodriguez. Signoret, Essai sur les Cochenilles.
(2) *A. personatus*, Comstock. On *L. commersonii*, J. F. Gmelin (syn. *borbonica*). Cockerell, Insect Life, V, p. 245.

PANDANEÆ.

The following occur on *Pandanus:*

(1) *Dactylopius pandani*, Cockerell. In Marquesas Islands. Cockerell, Psyche Supp., 1895, p. 16.
(2) *Ischnaspis filiformis*, Douglas. Cockerell, Journ. Trinidad Club, 1894, p. 306; Townsend, Journ. Inst. Jamaica, 1895, p. 169. On *P. vandermeeschii*, Balfour, and *P. "falcatus"* (? *furcatus*, Roxburg).
(3) *Pinnaspis* (olim *Mytilaspis*) *pandani*, Comstock. Cockerell, Journ. Trinidad Club, 1894, p. 307; Comstock, 2d Cornell Rept., p. 140.
(4) *Aspidiotus articulatus*, Morgan. Cockerell, Journ. Trinidad Club, 1894, p. 307.
(5) *A. pandani*, Signoret. On *P. utilis*, Bory, a native of Madagascar. Signoret, Essai sur les Cochenilles.
(6) *A.* (*Chrysomphalus*) *minor*, Berlese. On *P. graminifolius*.

AROIDEÆ.

Coquillett[1] records *Lecanium hesperidum*, Linnæus, from the so-called Calla lily, *Richardia africana*. *Colocaasia antiquorum* (syn. *esculenta*) is a food plant of *Dactylopius virgatus*, Cockerell.[2] *Ceroplastes floridensis*, Comstock, has been found on *Anthurium lanceolatum*.[3] *Mytilaspis carinatus*, Cockerell, occurs on some Anthurium-like plant.[4]

NAIADACEÆ.

The *Coccus zosteræ*, Fabricius, on *Zostera* is surely no coccid!

[1] Bull. 26, Div. Ent., U. S. Dept. Agric., p. 26.
[2] Bull. Bot. Dept., Jamaica, August, 1893, p. 3.
[3] Cockerell, Insect Life, 1893, p. 159.
[4] Cockerell, Psyche Supp., 1896, p. 21.

CYPERACEÆ.

Signoret records *Lecanium angustatum*, Signoret, and *Dactylopius cyperi*, Signoret, from *Cyperus papyrus*. *Aspidiotus cladii*, Maskell, is found on *Lepidosperma*,[1] as well as on *Cladium*.[2] *Mytilaspis cordylinidis* occurs on *Gahnia*.[3] *Orthezia cataphracta*, Shaw, is found about the base of stems of *Carex*.[4]

GRAMINEÆ.

The following are from grass, genus not stated:

(1) *Dactylopius radicum*, Newstead. Ent. Mo. Mag., 1895, p. 235.
(2) *D. hibernicus*, Newstead. Ent. Mo. Mag., 1895, p. 167.
(3) *D. herbicola*, Maskell. Tr. N. Z. Inst., XXIV, p. 36.
(4) *D. graminis*, Maskell. Tr. N. Z. Inst., XXIV, p. 36.
(5) *D. segregatus*, Cockerell. Bull Bot. Dept., Jamaica, August, 1893, p. 4; Journ. Inst. Jamaica, 1893, p. 254.
(6) *D. poæ*, Maskell. Scale Ins. N. Z., p. 112. On roots of tussock grass. Maskell, Tr. N. Z. Inst., XXII, p. 150.
(7) *D. arecæ*, Maskell. On roots. Maskell, Tr. N. Z. Inst., XXV, p. 231.
(8) *Rhizococcus quercus*, Comstock. 2d Cornell Rept., p. 139. It is really an *Eriococcus*.
(9) *Signoretia luzulæ*, Dufour. Maskell, Tr. N. Z. Inst., XXV, p. 224. It is a distinct variety, *australis*.
(10) *Icerya purchasi*, Maskell. Scale Ins. N. Z., p. 112.
(11) *Orthezia normani*, Douglas. Among the stems. Douglas, Trans. Ent. Soc. Lond., 1881, p. 301. Now considered a synonym of *O. floccosa*.
(12) *O. cataphracta*, Shaw. About base of stems. Douglas, Trans. Ent. Soc. Lond., 1881, p. 300.
(13) *Aspidiotus nerii*, Bouché. Comstock, 2d Cornell Rept., p. 139.

The following genera have coccid records:

(A) *Spartina*, Schreber.
(1) *Chionaspis spartinæ*, Comstock. On *S. stricta*. Comstock, 2d Cornell Rept., p. 140.
(2) *Ripersia maritima*, Cockerell. Insect Life, VII, p. 43.
(B) *Saccharum*, Linnæus.

The following are from the sugar cane, *S. officinarum:*

(1) *Icerya sacchari*, Guérin. Signoret, Essai. Now considered identical with *I. seychellarum*.
(2) *Dactylopius calceolariæ*, Maskell. Tr. N. Z. Inst. XXII, p. 149; Cockerell, Bull. Bot. Dept., Jamaica, February, 1893, p. 6. In Jamaica.
(3) *D. sacchari*, Guérin. Cockerell, Journ. Trinidad Club, 1895, p. 195.
(4) *Pulvinaria gasteralpha*, Signoret. Signoret, Essai sur les Cochenilles.
(5) *Aspidiotus sacchari*, Cockerell. Insect Life, VI, p. 103.
(C) *Calamagrostis*, Adans.

Signoret records *Eriopeltis lichtensteinii*, Signoret, and *Westwoodia perrisii*, Signoret.

(D) *Aira*, Linnæus.

[1] Maskell, Tr. N. Z. Inst., XXV, p. 205.
[2] Maskell, Tr. N. Z. Inst., XXIII, p. 3.
[3] Maskell, Scale Ins. N. Z., p. 112.
[4] Douglas, Trans. Ent. Soc. Lond., 1881, p. 300.

The problematical *Coccus chlæon*, Anderson, is from *Aira spicata*, which, however, is not an *Aira*, but a *Panicum* or *Trisetum*.

(E) *Corynephorus*, Beauvois.

Ripersia corynephori, Signoret, is from the south European *C. canescens*.

(F) *Danthonia*, De Candolle.

Eriococcus danthoniæ, Maskell, is from the New Zealand *D. cunninghamii*, J. D. Hooker.[1] *Dactylopius calceolariæ*, Maskell, has been found on *Danthonia*.[2]

(G) *Poa*, Linnæus.

(1) *Eriopeltis festucæ*, Fonscolombe. Signoret, Essai sur les Cochenilles.

(2) *Porphyrophora hamelii*, Brandt. Signoret, Essai sur les Cochenilles. Recorded from *P. pungens*, but this is really an *Eluropus*, either *A. pubescens* or *A. læris*.

(3) *Dactylopius poæ*, Maskell. On *P. anceps*, Forster, known in New Zealand as tussock grass. Maskell, Scale Ins. N. Z., p. 113.

(H) *Eluropus*, Trin. See above under *Poa*.

(1) *Porphyrophora hamelii*, Brandt. On *E. læris* (as *Aleuropus*). Signoret, Essai sur les Cochenilles.

(I) *Milium*, Linnæus.

Signoret records *Aclerda subtenanea* and *Antonina purpurea*, Signoret.

(J) *Bromus*, Linnæus.

Signoret records *Eriopeltis festucæ*, Fonscolombe.

(K) *Agropyrum*, J. Gærtner (or *Agropyron*).

Fairmairia bipartita, Signoret, is found on the European *A. campestre*, Godron and Grenier.

(L) *Triticum*, Linnæus.

Porphyrophora radicum-graminis, Baerensprung, has been found on wheat.[3]

(M) *Andropogon*, Linnæus.

Mr. E. E. Green sends me a new species, *Chionaspis graminis*, Green, found on *Andropogon* (lemon grass).

(N) *Bambusa*, Schreber (bamboo).

(1) *Sphærococcus bambusæ*, Maskell. Tr. N. Z. Inst., XXV, p. 237.

(2) *S.* (*Pseudolecanium*) *tokionis*, Cockerell. In Japan. Cockerell, Psyche Supp., 1896, p. 19.

(3) *Asterolecanium bambusæ*, Boisduval. Signoret, Essai; Cockerell, Sci. Goss., 1893, p. 77; Journ. Trinidad Club, 1894, p. 307. On *B. distorta*, Nees, according to Signoret.

(4) *A. miliaris*, Boisduval. Signoret, Essai; Cockerell, Journ. Trinidad Club, 1894, p. 307. On *B. distorta*, but also on *B. stricta*, which is a *Dendrocalamus* or *Oxytenanthera*.

(5) *Lecanium depressum*, Targioni. Maskell, Tr. N. Z. Inst., XXV, p. 220.

(6) *L. longulum*, Douglas. Maskell, Tr. N. Z. Inst., XXV, p. 221.

(7) *Chionaspis bambusæ*, Cockerell. In Japan. Cockerell, Psyche Supp., 1896, p. 21.

(8) *Diaspis patelliformis*, Sasaki. According to C. Sasaki.

[1] Maskell, Tr. N. Z. Inst., XVIII, p. 22.

[2] Maskell, Scale Ins. N. Z., p. 112.

[3] F. Löw, see Zool. Record for 1866.

FILICES.

The following are from ferns, genus not stated:

(1) *Dactylopius glaucus*, Maskell. Maskell, Scale Ins. N. Z., p. 112.
(2) *Ctenochiton depressus*, Maskell. Maskell, Scale Ins. N. Z., p. 112.
(3) *Lecanium mori*, Signoret. Maskell, Scale Ins. N. Z., p. 112; Tr. N. Z. Inst., XXVI, p. 75. See under *Nephrolepis*.
(4) *L. platycerii*, Packard. Comstock, 2d Cornell Rept., p. 139. A problematical species, not defined. See under *Platycerium*.
(5) *L. filicum*, Boisduval. Comstock, 2d Cornell Rept., p. 139. Cockerell, Bull. Bot. Dept. Jamaica, 1894, p. 72; Trans. Amer. Ent. Soc., 1893, p. 55; Maskell, Tr. N. Z. Inst., XXV, p. 220 († on *Lomaria*). See under *Davallia*.
(6) *L. hemisphæricum*, Targioni-Tozzetti, var. *hibernaculorum*, Boisduval. Cockerell, Bull. Bot. Dept. Jamaica, 1894, p. 71.
(7) *Vinsonia stellifera*, Westwood. Cockerell, Journ. Trinidad Club, 1894, p. 306.
(8) *Chionaspis braziliensis*, Signoret. Cockerell, Journ. Trinidad Club, 1894, p. 306; Maskell, Tr. N. Z. Inst., XXV, p. 211.
(9) *C. dubia*, Maskell. Scale Ins. N. Z., p. 112. See under *Pellæa* and *Asplenium*.
(10) *Poliaspis media*, Maskell. Scale Ins. N. Z., p. 112.
(11) *Ceroplastes floridensis*, Comstock. Cockerell, Amer. Nat., 1895, p. 727.
(12) *C. rubens*, Maskell. Sent by Mr. Ehrhorn on fern from Honolulu. (Craw coll.)
(13) *Pulvinaria* sp. On fern from Honolulu. (Craw, through Ehrhorn.)

The following genera have coccid records:

(A) *Platycerium*.

The unrecognized *Lecanium platycerii*, Packard, was found on this. *L. oleæ*, Bernard, occurs on *P. alcicorne*.[1]

(B) *Pteris*.
(1) *Eriococcus insignis*, Newstead. Ent. Mo. Mag., 1891, p. 165.
(2) *Lecanium filicum*, Boisduval. Signoret, Essai. This and the next are found on *P. quadriaurita* var. *argyræa* (syn. *P. argyræa*).
(3) *Dactylopius pteridis*, Signoret. Signoret, Essai sur les Cochenilles.
(C) *Polypodium*.
(1) *Mytilaspis phymatodidis*, Maskell. Scale Ins. N. Z., p. 113. On *P.* (*Phymatodes*) *billardieri*.
(D) *Pellæa*.
(1) *Chionaspis dubia*, Maskell. On *P. rotundifolia*, a fern of New Zealand and Norfolk Island. Maskell, Scale Ins. N. Z., p. 113.
(E) *Nephrolepis*.
(1) *Lecanium mori*, Signoret. On *N. cordifolia*. Maskell, Tr. N. Z. Inst., XXVI, p. 76.
(2) *L. hemisphæricum*, Targioni-Tozzetti. On *N. exaltata*. Gillette and Baker, Hemip. Colo., p. 127.
(F) *Nephrodium*.
(1) *Lecanium hemisphæricum*, Targioni-Tozzetti. Cockerell, Journ. Inst. Jamaica, I, p. 373.
(G) *Davallia*.
(1) *Lecanium filicum*, Boisduval. On *D. canariensis*. Coquillett, Bull. 26, Div. Ent., U. S. Dept. Agric., p. 27.
(H) *Alsophila* (tree ferns).
(1) *Lecanium mori*, Signoret. On *A. colensoi*. Maskell, Tr. N. Z. Inst., XXVI, p. 75.

[1] Cockerell, Amer. Nat., 1895, p. 727.

(I) *Adiantum* (maidenhair):

(1) *Dactylopius longispinus*, Targioni-Tozzetti (*longifilis*). Cockerell, Journ. Inst. Jamaica, 1892, p. 97; Ent., 1893, p. 266; Ann. Mag. Nat. Hist., 1895, p. 61.

(J) *Asplenium*.

(1) *Lecanium mori*, Signoret. On *A. flaccidum*. Maskell, Tr. N. Z. Inst., XXVI, p. 76.

(2) *Mytilaspis cordylinidis*, Maskell. Comstock, 2d Cornell Rept., p. 139.

(3) *Chionaspis dubia*, Maskell. On *A. bulbiferum* and *A. obtusatum* var. *lucidum*. Maskell, Scale Ins. N. Z., p. 111; Tr. N. Z. Inst., XXIII, p. 8.

(K) *Doodia*.

(1) *Lecanopsis filicum*, Maskell. On *D. aspera*, an Australian species. Maskell, Tr. N. Z. Inst., XXVII, p. 17.

(L) *Cyathea* (tree ferns).

(1) *Ctenochiton depressus*, Maskell. On *C. Smithii*. Maskell, Scale Ins., N. Z., p. 112.

MUSCI.

Dactylopius poæ, Maskell, occurs among moss at base of trees.[1] *Orthoziola rejdorskyi*, Sulc, is found under leaves and moss (Sulc).

[1] Maskell, Tr. N. Z. Inst., XXIII, p. 23.

NOTES ON LARVAL CESTODE PARASITES OF FISHES.

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THE material upon which these notes are a partial report belongs to two distinct collections:

First. A collection made by myself at Woods Holl, Massachusetts.

Second. A collection belonging to the United States National Museum.

Both of these collections are large, aggregating about 600 bottles and vials. By far the larger part of the collections are entozoa of fish. A report on material representing such a wide range of species, some of the species represented by very few or by but one specimen, can not be other than unsatisfactory. It is hoped, however, that the notes here given may prove to be of some assistance to future investigators in the work of identification.

It should be remarked that the finding of a larval cestode parasite encysted in the tissues of a fish is not always proof that the fish is a true intermediate host. This goes without saying when the host of the encysted parasite is a large shark. Beneden invented the term *xenosite*—i. e., stranger—for this condition of parasitism.

List of parasites and hosts.

No.	Parasite.	Host.	Plate.	Figure.
1	*Ligula chilomycteri*	*Chilomycterus geometricus*	I.	1
2	Cysts	*Sarda sarda*	I.	2, 3
		Cynoscion regalis	I.	6–13
		Limanda ferruginea	I.	4
3	Larval *Echenebothria*	*Stenotomus chrysops*		
		Paralichthys dentatus	I.	14, 15
		Lophius piscatorius	I.	5
4	*Phyllobothrium loliginis*	*Ommastrephes illecebrosus*	II.	1–9
5	*Thysanocephalum*, sp	*Ommastrephes illecebrosus*	II.	10, 11
6	*Rhynchobothrium bulbifer*, Linton	*Alutera schoepfii*		
		Pomatomus saltatrix		
7	*Rhynchobothrium* larvæ:			
	(1)	*Centropristes striatus*	II.	12
	(2)	*Caranx chrysos*	II.	13–15
	(3)	*Anguilla chrysypa*	II.	16
			III.	1
	(3a)	*Cynoscion regalis*	IV.	1
	(4)	*Microgadus tomcod*	III.	2
	(5)	*Scomberomorus regalis*		
	(6)	*Sarda sarda*		
	(7)	*Prionotus evolans*	III.	3–5
	(8)	*Menticirrus saxatilis*	III.	6
	(9)	*Physis tenuis*		

List of parasites and hosts—Continued.

No.	Parasite.	Host.	Plate.	Figure.
7	*Rhynchobothrium* larvæ—Continued.			
	(10)	*Physis chuss*		
	(11)	*Macrurus bairdii*	III.	7, 8
	(12)	*Stenotomus chrysops*	III.	9–13
	(13)	*Carcharias littoralis*	III.	14–17
	(14)	*Pomatomus saltatrix*	III.	17–19
	(15)	*Paralichthys dentatus*		
	(16)	*Alutera schœpfii*		
	(17)	*Carcharias littoralis*		
	(18)	*Mustelus canis*	IV.	2
	(19)	*Cottus*, sp.		
	(20)	*Cottus*, sp.		
	(21)	*Cynoscion regalis*		
	(22)	*Paralichthys oblongus*		
8	*Rhynchobothrium heterospine*, Linton	*Anguilla rostrata*	IV.	3–8
		Paralichthys dentatus	IV.	9–12
		Lophius piscatorius		
		Microgadus tomcod		
		Scomber scombrus		
		Bothus maculatus		
9	*Rhynchobothrium imparispine*, Linton	*Tautoga onitis*		
		Cetropriste striatus		
		Gadus callarias		
		Melanogrammus æglefinus		
		Acanthocottus æneus		
		Paralichthys dentatus	IV.	13, 14
		Pomatomus saltatrix	V.	1–3, 7
		Stenotomus chrysops		
		Tylosurus caribbæus	V.	4, 5
10	*Rhynchobothrium speciosum*, new species	*Cynoscion regalis*	V.	6
		Scomber scombrus		
		Chætodipterus faber		
		Echeneis remora		
11	*Rhynchobothrium attenuatum*, Rudolphi	*Xiphias gladius*	V.	8–11
12	*Otobothrium dipsacum*, new species	*Pomatomus saltatrix*	VI.	1–5
13	*Tetrarhynchus, larvæ:*			
	(1)	*Carcharinus obscurus*		
	(2)	*Sphyrna zygæna*		
	(3)	*Scomberomorus regalis*		
	(4)	*Chætodipterus faber*	VI.	8, 9
	(5)	*Trygon centrura*		
	(6)	*Mustelus canis*	VI.	6, 7
	(7)	*Raia erinacea*		
	(8)	*Lophius piscatorius*		
	(9)	*Tetrapturus imperator*		
	(10)	*Pseudopleuronectes americanus*		
	(11)	*Stromateus triacanthus*	VI.	10
		Paralichthys dentatus	VI.	11
		Cynoscion regalis	VI.	12, 13
14	*Tetrarhynchus bisulcatum*, Linton	*Tetranarce occidentalis*	VI.	14, 15
		Stenotomus chrysops		
		Seriola zonata		
15	*Tetrarhynchus erinaceus*, Beneden	*Cynoscion regalis*	VII.	1–5
16	*Tetrarhynchus elongatus*, Wagener	*Pomatomus saltatrix*	VII.	6–8
		Mola rotunda	VII.	9–12
		Coryphæna hippurus	VIII.	2
17	*Tetrarhynchus bicolor*, Bartels	*Xiphias gladius*	VIII.	1
		Carcharinus obscurus	VIII.	5, 6
		Galeocerdo tigrinus	VIII.	3, 4
		Pomatomus saltatrix	VIII.	12
		Cynoscion regalis	VIII.	7, 11
		Mustelus canis	VIII.	9
		Scomberomorus regalis		
18	*Symbothrium filicolle*, Linton	*Pomolobus mediocris*		
		Trygon centrura	VIII.	10
		Lobotes surinamensis		
		Scomberomorus cavalla		
		Scomberomorus maculatus		
		Paralichthys dentatus	VIII.	8

1. LIGULA CHILOMYCTERI. (Dibothrium larva.)

(Plate I, fig. 1.)

From spleen of rabbit-fish (*Chilomycterus geometricus*) Woods Holl Massachusetts, July 21, 1887 (No. 4791, U.S.N.M.).

A specimen inclosed in a membranous cyst and coiled up irregularly

in the spleen of its host appears to be a *Ligula*. Its length, in life, was 100 mm., the breadth of the anterior fourth about 6 mm., that of the posterior three-fourths about 2 mm. When placed in sea water, constrictions formed at intervals throughout the length, and the anterior end, which before was retuse, became conical.

The alcoholic specimen is quite irregularly contracted, but at the anterior end it is smooth, regular, with conical apex. Transverse striæ begin about 2 mm. from the anterior tip. Transverse sections show the muscular layers of the body wall and the central parenchyma with the beginnings of the reproductive organs.

2. Cysts from Bonito.

(Plate I. figs. 2, 3.)

Small cysts from peritoneum of the bonito (*Sarda sarda*) Woods Holl, Massachusetts, August 5, 1889 (No. 4785, U.S.N.M.).

Dimensions of alcoholic specimens: Length of cyst, 2.5 mm.; breadth, 1.25; length of embryo, 2.25; diameter of embryo, 0.34 to 0.43; principal diameters of one of the oval bodies at larger end. 0.044 and 0.018—of another, 0.035 and 0.022.

The cysts look like *Dibothrium* cysts. The larvæ are worm-like in shape, with a thin body wall in which are both longitudinal and circular fibers. Oval and spheroidal bodies which do not yield carbon dioxide with acetic acid fill the interior of the body at the larger end and extend to near the middle of the body. These bodies give to that part of the body in which they lie a dark amber color. Elsewhere the body of the alcoholic specimen is light yellow.

Forms similar to these noticed among specimens from peritoneum of file-fish (*Alutera schœpfii*) Woods Holl, Massachusetts, August 5, 1889.

3. Larval ECHENEIBOTHRIA.

(Plate I, figs. 4–15.)

Echeneibothria, LINTON, U. S. Fish Com. Rept., 1886, pp. 453, 454, pl. VI, figs. 6, 7.

1. During the months of July and August, 1889, at the Fish Commission Laboratory, Woods Holl, Massachusetts, I examined, in all, seventy-three specimens of squeteague (*Cynoscion regalis*) and in all instances found the cystic duct infested with, as a rule, enormous numbers of larvæ.

These forms have already been noticed and figured, and since I have made no special study of their structure, I simply add here a few extracts from notes made at the time of collecting.

In some specimens two small red granular patches were observed on neck, back of head. Length, when extended, as much as 7.5 mm., contracting to 1.5 mm. In one lot the length when extended was from 5 to 6 mm., the breadth varying from 0.18 to 0.36 with the amount of expansion.

A small specimen in this lot with costate bothria had no red patches

on the neck. Its dimensions, living, were: Length, 0.45 mm.; breadth, 0.08; length of bothria, 0.1; breadth of head, 0.12.

In addition to those found infesting the cystic duct, others were found in the intestine of some of the fish examined. Of these there were two types, as in those of the cystic duct.

First type with a costa on each bothrium, the bothria long elliptical, body slender, proboscis (myzorhynchus) very extensible, cylindrical, with small round shallow mouth. Second type larger, stouter, with two distinct red blotches back of the bothria, no costae on bothria, or with only a faint indication of a costa on the anterior part, proboscis (myzorhynchus) round elliptical, extensible campanulate, often maintained in a comparatively rigid position with flaring bell-shaped or vase-shaped border widely open at the apex. When at rest, the body is invaginated and often contracts until it is oval or sometimes almost circular in outline. When this is the case, transverse wrinkles are apt to form on the posterior part of the body.

The specimens in the intestines were much smaller, as a rule, than those in the cystic duct.

They were found in myriads (No. 4789, U.S.N.M.) in a squeteague examined on August 18, 1886, in the chyle and adhering to the mucous membrane of the intestine. When extended until the body was quite filiform, they were as much as 2.1 mm. in length: when contracted and the head involuted, they became as short as 0.35 mm. and nearly circular in outline. Posterior edges of bothria free.

Measurements of three specimens were made with the following results, given in millimeters: First specimen, length, 0.45, breadth, 0.28; second specimen, length, 0.84, breadth, 0.17; third specimen, length, 1.05, breadth, 0.12. When these specimens are compared with respect to their superficial areas, it will be seen that they may be represented by the numbers 126, 142, and 126 respectively. Indeed dimensions corresponding to those of the first and third specimens might have been obtained without difficulty from a single living and actively contracting specimen.

Length of bothria about 0.14 mm.; breadth, 0.07 to 0.1.

Body with many highly retractile oval masses.

The primary host, or hosts, of these larvae will doubtless be found among the various species of crabs which inhabit the feeding grounds of the squeteague and flounder. Forms resembling them have been figured by Beneden from *Carcinus* and *Pagurus* (Les Vers Cestoides, Plate I, figures 10–14), as well as from various species of fish. Wagener (Entwickelung der Cestoden, Plate 9, fig. 10 etc.) also figures forms which bear a general resemblance. The latter, however, are all from piscine hosts.

2. Larvae from intestine of sand-dab (*Limanda ferruginea*) (No. 4814, U.S.N.M.), Woods Holl, Massachusetts, September 6, 1887.

Alcoholic specimens 2 to 2.5 mm. in length. These agree closely with some of Beneden's figures of scoleces from *Rhombus* (*Cestodes*, Plate I).

3. In a vial containing a cyst of a *Rhynchobothria unus* from the peritoneum of the scup (*Stenotomus chrysops*), Woods Holl, Massachusetts, July 23, 1887.

I find specimens of larval *Tetrabothria* identical with those from cystic duct of *Cynoscion regalis*. Length, 0.7 mm.; breadth, 0.3. mm.

My note made at the time of collecting is: "No. 165, July 23, 1887. Examined about a dozen specimens of *Stenotomus chrysops* found only a few cysts and embryo Cestodes." The latter may refer to the specimens here described.

4. I have found a parasite, which agrees exactly with those from the cystic duct of the Squeteague, in the common flounder (*Paralichthys dentatus*), at Woods Holl, Massachusetts, on three different occasions, namely, August, 1884, July 16 and 23, 1887 (No. 4788 U.S.N.M.).

Among the flounders examined July 16, 1887, was one whose cystic duct was infested with these parasites in the same manner as that of the Squeteague.

One specimen in this lot was noticed in which there was what appeared to be the beginning of a bifurcation of the tail (fig. 15a).

When specimens were placed in fresh water, many of them swelled up at the anterior end, becoming club-shaped or even decanter-shaped (fig. 14). In these the epidermis soon loosened and separated from the body, or rose into wrinkles.

5. Larvæ identical with those from the intestine of the squeteague were found on three occasions in the intestine of the goose-fish (*Lophius piscatorius*), at Woods Holl, Massachusetts, July 7, 1885, August 6 and August 30, 1887, in enormous numbers (No. 4786, U.S.N.M.).

In the first and second lots the living specimens varied from 1 to 2 mm. in length. When placed in alcohol, they become conical in shape, larger end anterior, from 0.4 to 0.5 mm. in length. Head of living specimen usually about 0.24 mm. in breadth, and was capable of introversion; bothria and myzorhynchus as in specimens from squeteague. Two red spots on neck.

The specimens in the third lot varied in length from 0.8 mm. to 4.5 mm.

Bothria four, oval, with apparently two transverse costæ dividing the bothria into three loculi. Two red spots in neck, only seen when worm is viewed on its flat surface; in lateral, i. e., marginal, view only one spot is seen.

There is, as in specimens from squeteague, a protrusible papillary eminence (myzorhynchus) with an os in the apex leading into a globular proboscis, as in *Echeneibothrium variabile*. No true segments appeared on any, although on the large specimens one or more transverse lines divided the body into irregular pseudosegments.

In a specimen which was placed in fresh water the bothria contracted and were directed forward, and the head assumed a globular shape.

The four bothria with the central os then gave to the head a strong resemblance to the head of *Tænia*.

These larvæ appear to belong to the genus *Echeneibothrium*.

Although found in such great numbers and so often, especially in the Squeteague, I am not disposed to think that any of the fish in which I have found these interesting forms is either the true intermediate or the proper final host of the species.

It is likely that different species are represented among these larvæ.

4. PHYLLOBOTHRIUM LOLIGINIS.

(Plate II, figs. 1-9.)

Taenia loliginis, LEIDY, Proc. Acad. Nat. Sci. Phila., 1887, p. 24.

Tetrabothrium or *Phyllobothrium loliginis*, LEIDY. Proc. Acad. Nat. Sci. Phila., 1890, p. 418.

From stomach of squid (*Ommastrephes illecebrosus*). Collected at Woods Holl, Massachusetts. The squids were taken at Provincetown, Massachusetts (No. 4801, U.S.N.M.).

The living specimens attained a length of over 20 mm.; head and neck a delicate pink or flesh color and subtransparent; body ivory white, less transparent than head and neck, and with denser refractile granules. Bothria four, very variable, with crumpled or folded border, each with an auxiliary acetabulum, a terminal papillary eminence (myzorhynchus), with fine radiating fibers. Dimensions of one of the larger specimens in millimeters, somewhat compressed: Length, 18; breadth of head, 5; breadth of neck, 3.5.

The bothria are very extensible, sometimes elongated, at other times contracted, again spread out into a large flat disk and applied to the bottom of the dish and used in locomotion (fig. 3). The lateral vessels show plainly through the transparent walls of the head and neck and can be traced to the posterior end of the body. The body becomes wider than the neck, is flat, and tapers to a point behind.

The alcoholic specimens are corrugated and puckered.

Dimensions of one of the larger alcoholic specimens: Length, 14 mm.; diameter of head, 1.5; breadth of neck, 0.7; greatest breadth of body, 1.2.

The smallest specimens in the lot are only 1.25 mm. in length.

5. THYSANOCEPHALUM sp. (Larva).

(Plate II, figs. 10-11.)

One small specimen, 1 mm. in length, from the stomach of the squid (*Ommastrephes illecebrosus*). Collected, August 28, 1886, at Woods Holl, Massachusetts. The squids were caught at Provincetown, Massachusetts (No. 4815, U.S.N.M.).

The specimen is the young of my genus *Thysanocephalum*, and presumably of the species *T. crispum*.[1]

Only the scolex present.

[1] U. S. Fish Com. Rept., 1888, pp. 543-556, pls. LXI-LXVII.

6. RHYNCHOBOTHRIUM BULBIFER, Linton. (Larva.)

Rhynchobothrium bulbifer, LINTON, U. S. Fish Com. Rept., 1886, pp. 486–488, pl. v, figs. 17, 18; 1887, pp, 825–829, pl. xi, figs. 1 and 2.

I have met on a few occasions larval *Rhynchobothria*, some of which have been sufficiently developed to refer without doubt to this species (No. 5457, U.S.N.M.), using the hooks as the principal criterion; others have been referred with some doubt to this species.

The specimens were all collected at Woods Holl, Massachusetts, one lot from the filefish (*Ulutera schoepfii*), August 12, 1885. The other lots are from the bluefish (*Pomatomus saltatrix*), one collected in August, 1884, another in July, 1887, three in July, 1889, and two in August, 1889.

One specimen from a bluefish agreed in the size and arrangement of the hooks, and in character and dimensions of bothria, neck, and contractile bulbs, with *R. bulbifer*. Others from same host, very small, too rudimentary for satisfactory identification, are probably the young of this species, while others are more probably young of *R. speciosum*.

The specimens from the filefish do not agree so well in size of contractile bulbs, being shorter, and other dimensions shorter—i. e., head and neck, 1.9 mm. in length, agree in the character of the hooks and appear to be the young of this species.

7. RHYNCHOBOTHRIUM LARVÆ.

(Plates II, figs. 12–16; III, figs. 17–35; IV, figs. 1–2.)

I have found, on many occasions and in a great variety of hosts, encysted *Rhynchobothria*, which I have been unable to identify or can determine only doubtfully. I here record such notes as I have made, endeavoring to so group the different kinds as to make the notes of some value to others for purposes of identification.

I.

I include here larval *Rhynchobothria*, from a number of hosts, which have much in common, and probably belong to the same or to closely related species.

1. Notes of two finds of *Rhynchobothrium* larvæ in sea bass (*Centropristes striatus*) have been made. Measurements on a specimen collected at Woods Holl, Massachusetts, August, 1884: Length, 1.03 mm.; length of bothrium, 0.18; length of contractile bulbs, 0.6; breadth of head, 0.23; diameter of neck, 0.21; length of longest hooks, 0.026. The specimen was encysted in the serous coat of the intestine of its host. The proboscides were retracted and the hooks of various styles, but their arrangement could not be made out. They bear some resemblance to those of *R. longispine*, Linton.

Another from the same host and locality, collected August 6, 1886, evidently the same, has hooks which agree in length with the other, but rather sparsely distributed. The proboscides were estimated to be

0.8 mm. in length, and were 0.04 in diameter (Plate II, fig. 12). (No. 4760, U.S.N.M.)

2. Cysts from the crevalle (*Caranx chrysos*). The embryos contained in these cysts are small, but the proboscides are relatively long. Some of the dimensions are: Length of proboscis, approximate, 1.5 mm.; diameter, exclusive of hooks, 0.02; length of contractile bulbs, 0.38; diameter, 0.09; length of longest hooks observed, 0.015 (Plate II, figs. 13–15). (No. 4769, U.S.N.M.)

The contractile bulbs were slightly sinuous. The hooks bear some resemblance to those of *R. heterospine*, Linton.

3. Cysts collected at Woods Holl, Massachusetts, August 26, 1885, July 23, and September 1, 1886, and August 20, 1889, from the peritoneum of the common Eel (*Anguilla chrysypa*) (Plate II, fig. 16). (No. 4764, U.S.N.M.)

The proboscides were retracted and the arrangement of hooks was difficult to make out, but they appear to be identical with those of the specimens from *Caranx*, mentioned above. The longest hooks were about 0.011 mm. in length.

Dimensions of a living specimen somewhat compressed (Plate III, fig. 1): Length of embryo, 5 mm.; length of bothrium, 0.7; breadth of bothrium, 0.63; diameter of neck, narrowest part, 0.35; length of proboscis, estimated on retracted organ, 1.4; length of contractile bulbs, 0.42; diameter of contractile bulbs, 0.07 (No. 4774, U.S.N.M.).

3*a*. Figure 1, Plate IV, is a sketch of a cyst from the stomach wall of *Cynoscion regalis*, Woods Holl, Massachusetts, September, 1884.

The sketch represents the cyst compressed so as to show the blastocyst and embryo. This appears to be identical with the specimens from *Caranx* and *Anguilla*. (No. 4826, U.S.N.M.)

4. Cysts from mucous membrane of the tomcod (*Microgadus tomcod*), Woods Holl, Massachusetts, July 23, 1886. These agree very closely with the specimen described above, especially with those from *Anguilla chrysypa*. The cysts were elongate-pyriform, with the embryo coiled up in the larger end (Plate III, fig. 2). The elongated neck-like part of the cyst was dull yellowish: the embryo ivory white surrounded by the translucent white blastocyst. The latter when removed was also pyriform-elongate, or rather gourd-shaped, with the embryo in the larger end (No. 4832, U.S.N.M.).

5. Cysts from the cero (*Scomberomorus regalis*), Woods Holl, Massachusetts, July 30, 1889, peritoneum, associated with larvæ of tetrarhynchus (Cat. No. 5475, U.S.N.M.). Details of hooks could not be made out; general habit of larvæ like those described above. Length of cysts, 2.8 mm.

6. Larger cysts from same host, same locality, August 13, 28, 1889, peritoneum. In first lot the proboscides were retracted, approximately, 3 mm. in length; length of longest hooks observed was 0.02. Second lot, cyst oblong, 3.5 mm. long and 1.25 broad; embryo about 5 in length;

bothria 0.56 long and 0.45 broad; longest spines nearly 0.03 in length. Bothria converging in front, strongly divergent behind.

6*a*. Small cysts between submucous and muscular coats of stomach of the bonito (*Sarda sarda*) (Cat. No. 5458, U.S.N.M.). Woods Holl, Massachusetts, August 28, 1889. Length of embryo 0.38, of bothria 0.23, and of largest hooks 0.01 mm.

Alcoholic specimens with yellowish blastocysts, the embryo a deeper yellow; parenchyma of blastocyst coarsely granular.

7. Cysts from peritoneum of the sea robin (*Prionotus evolans*), Woods Holl, Massachusetts, July 21, 1887. The cysts are, in alcohol, small oval: Length, 1.6 mm.; breadth, 0.75; length of embryo, about 1 mm. Proboscides of embryos retracted and arrangement of hooks not evident, but bears some resemblance to *R. longispine*. Length of longest hooks about 0.02 mm. (Plate III, figs. 3, 4, 5). (No. 4757, U.S.N.M.)

II.

The larvæ enumerated in this section belong to the same or to closely related species.

8. Cysts from peritoneum of the whiting (*Menticirrus saxatilis*), belonging to the United States National Museum Collection; but all collected at Woods Holl, Massachusetts, by Vinal N. Edwards (Plate III, fig. 6). (No. 4754, U.S.N.M.)

These were collected as follows: Nov. 10, 1886; Nov. 12, 1886; and Nov. 16, 1886.

The blastocysts, in alcoholic specimens, are nearly all dark brown, especially toward posterior end; the anterior end, which contains the coiled-up embryo, is lighter colored. Length of blastocysts, in most cases, 4 to 5 mm.; a few are longer and several shorter. Length of embryo 4 mm., neck tubular, bothria two, broadly elliptical, distinctly emarginate and somewhat bilocular, widely divergent posteriorly. Other dimensions: Length of contractile bulbs, 1.5 mm.; diameter of same, 0.25; length of bothrium, 0.8; diameter of neck, 0.68; proboscis probably nearly three times the length of the bothria, with spiral sheaths; hooks of various sizes—longest 0.06, shortest about 0.005. Calcareous bodies numerous and large, as much as 0.05 in length and 0.025 in breadth, with concentric structure, showing rather smaller in neck and head than behind contractile bulbs.

The proboscides were retracted, and it was not possible to make out the arrangement of the hooks. Two or four rows of large hooks flanked by slender hooks, with minute hooks on opposite side, appear to be the plan. It will be seen that this form bears a close resemblance to *R. imparispine*, but large hooks not so strongly curved as in that species.

9. Cysts from peritoneum of *Phycis tenuis* (No. 4607, U.S.N.M.). Collected by United States Fish Commission, 1883, station 1157.

One specimen, when removed from the small white cyst, was found to agree in all essential particulars with the specimen from *Menticirrus*.

10. Cysts from peritoneum of *Phycis chuss*, Woods Holl, Massachusetts, August 29, 1887 (No. 4762, U.S.N.M.).

Blastocyst with very coarse refractile bodies in the parenchyma.

Dimensions of alcoholic specimens: Length of head and neck, about 2 mm.; length of bothrium, 0.37; breadth, 0.32; diameter of neck, 0.24; length of contractile bulbs, 0.47; length of largest broad hooks, 0.044; length of long slender hooks, 0.035.

11. Cysts from *Macrurus bairdii* (No. 4773, U.S.N.M.). Collected by United States Fish Commission, station 894.

Dimensions: Length of blastocyst, 18 mm.; diameter of anterior end, 3; of posterior end, 2; length of embryo, 3.7; diameter of neck, 0.7; length of bothria, 0.75; length of longest hooks, at base of proboscis, about 0.05; length of contractile bulbs, 1.7; longest diameters of calcareous bodies observed, 0.03 (Plate III, figs. 7, 8).

The proboscides are about three times as long as the bothria, sheaths spiral. The arrangement of hooks could not be made out. Hooks of various sizes. Not shaped like those of *R. imparispine*.

III.

The species in this section are distinct for each host.

12. Two lots of cysts from the scup (*Stenotomus chrysops*) were collected at Woods Holl, Massachusetts, August, 1884, and July 23, 1887. On the latter date about a dozen fish were examined and only a few cysts found.

In the first lot the cysts are smaller than they are in the second, but they are evidently the same species.

Dimensions: Length of cyst, 1.1 mm.; breadth of cyst, 0.8; length of embryo, 0.84; breadth, 0.78. Proboscides retracted. Hooks of two kinds (Plate III, fig. 9). Length of longest, slender hooks, 0.023 mm., (Nos. 4775, 4765, U.S.N.M.).

Along with the cyst in the first lot were several slender cysts, with slender blastocyst, whose identity I was unable to determine. One of these measured 6.5 mm. in length, and from 0.18 to 0.46 in diameter. No traces of embryo could be found. Numerous calcareous bodies were present in the interior, some of them showing a concentric structure, others yellowish opaque without distinct structure, average size about 0.05 mm.

An embryo taken from a cyst in the second lot yielded the following measurements, alcoholic specimen: Length of bothrium, 0.76 mm.; breadth of bothrium, 0.4; breadth of head, 1.05; diameter of proboscis at base, including hooks, 0.06; diameter of proboscis in front of tumid base, 0.05; length of shortest hooks, 0.005; length of longest hooks, 0.024.

The bothria have a deep central depression and thick edges, are widely divergent at base so as to appear almost terminal. The approximate length of a proboscis was 2 mm.

During life these embryos, when liberated from the blastocyst, showed the structure with unusual clearness. The muscular retractor of the proboscis was demonstrated (Plate III, fig. 12) and traced to its insertion near the base of the contractile bulbs, and seen to be distinctly fibrous (Plate III, fig. 13). Circular muscles seen in walls of contractile bulbs and also in walls of proboscides. An irregular granular mass near apex of head was probably the nerve ganglion. Two principal branches led back from it, but could be traced for only a short distance.

The surface of the bothria was densely covered with minute bristles.

A granular ribbon with irregular outlines was seen through the transparent walls of the extended proboscides (Plate III, fig. 12 *g*) in the living specimen.

13. This singular specimen (Plate III, figs. 14, 15, 16) was found in a bottle containing specimens of *R. longicorne*, from the spiral intestine of the sand shark (*Carcharias littoralis*), Woods Holl, Massachusetts, August 12, 1887. No notes were made on the living specimen (No. 4763, U.S.N.M.). Dimensions of alcoholic specimen: Length, 4 mm.; breadth of head, 0.37; diameter of neck, 0.28; length of contractile bulbs, 0.04; length of head and neck to base of bulbs, 0.94; length of largest hooks, near base of proboscis, 0.04; length of small hooks, toward apex of proboscis, 0.006. The body is vase-shaped and intimately attached to the neck. Four elongated racemose clusters of oval or pyriform bodies extend from about the front end of the contractile bulbs nearly to the posterior end of the body. The proboscides were retracted, and the character of the hooks could not be made out satisfactorily. The proboscis appears to be swollen at the base. Several large stout hooks, and some straightish ones, at the base of the proboscis; beyond the base the hooks are much smaller.

14. Figs. 17, 18, 19, Plate III, are sketches of a larval *Rhynchobothrium* from a cyst on the liver of the bluefish (*Pomatomus saltatrix*), collected at Woods Holl, Massachusetts, September, 1884.

This specimen (No. 4771, U.S.N.M.) was associated with specimen of *R. speciosum*, but was much smaller than specimens of that species of corresponding degree of development. The length of the entire specimen (fig. 17) was about 11 mm.; the breadth of a bothrium, 0.56.

IV.

In this section are included notices of the occurrence of encysted *Rhynchobothria* whose specific identity could not be determined even approximately, usually on account either of the immature condition of the embryo, or because of the degeneration of the tissues of the blastocyst itself.

15. Cyst from peritoneum of common flounder (*Paralichthys dentatus*), Woods Holl, Massachusetts, August, 1884.

These contained small scoleces of *Rhynchobothrium;* proboscides retracted, hooks of three or more kinds, their arrangement not clearly made out, but their shape and size point to *R. bulbifer.*

16. Small cysts and free embryos found on several occasions as follows, all at Woods Holl, Massachusetts, in the filefish (*Alutera schoepfii*), August, 1884, twice; July 31 and August 12, 1885; July 13 and August 13, 1887; August 5, 1889 (No. 4869, U.S.N.M.). These specimens occur in enormous numbers, appearing as small white specks lying under the serous coat of the stomach and intestine.

They are of various sizes; one measured 1.3 mm. in length and 0.2 in breadth. There are doubtless different species represented among these larvæ.

17. Cysts from walls of stomach and intestine of the sand shark (*Carcharias littoralis*), Woods Holl, Massachusetts, August 2, 1886. These cysts are small, less than 1 mm. in length, containing blastocyst with embryo, too small and young for successful identification, evidently a xenosite (Beneden).

18. (No. 4836, U.S.N.M.) A single blastocyst (Plate IV, fig. 2) from stomach of dogfish (*Mustelus canis*), evidently introduced with the food; stomach with nearly digested fish and crabs. Collected August 1, 1889, Woods Holl, Massachusetts.

The blastocyst was living and active, but embryo not liberated. Length, 14 mm.; diameter, 0.8, of nearly uniform size throughout, slightly swollen at anterior end, which contained a small embryo about 0.048 in diameter at extreme anterior tip. Too rudimentary to identify, but from appearance of blastocyst it is probably a *Rhynchobothrium*.

19. Blastocyst from wall of stomach of sculpin (*Cottus*, sp.) (No. 5497, U.S.N.M.), Woods Holl, Massachusetts, November 11, 1897. Collected by Vinal N. Edwards. Length, 20 mm.; diameter, 1.5; color, yellow. The specimen is filled with crumbling parenchyma, is easily broken, and there is no trace of an embryo.

20. Cysts from sculpin (*Cottus*, sp.) (No. 5498, U.S.N.M.), Woods Holl, Massachusetts, November 6, 1886. Collected by Mr. Vinal N. Edwards. The bottle contains pieces of muscular tissue with a few small fusiform cysts which have degenerated into a waxy and partly calcareous substance, and therefore possess no characters by which they can be classified. It is possible that they may not be *Rhynchobothrium* cysts at all, but sporocysts.

21. Cyst from spleen of squeteague (*Cynoscion regalis*) (No. 5499, U.S.N.M.) Woods Holl, Massachusetts. July 27, 1887.

This cyst was globular in shape and measured 15 mm. in diameter while living, and 12.5 as an alcoholic specimen. It was not opened until it had been in alcohol for sometime, when it was found to contain coagulated parenchyma, but no trace of an embryo could be made out.

22. Cysts from peritoneum of flounder (*Paralichthys oblongus*) (No. 5500, U.S.N.M.), Woods Holl, Massachusetts, August 29, 1887. Cysts contained larval *Rhynchobothria;* proboscides retracted, hooks of various sizes and shapes. Bears some resemblance to *R. imparispine*, but scolex much smaller.

8. RHYNCHOBOTHRIUM HETEROSPINE, Linton.

(Plate IV, figs. 3–8.)

Rhynchobothrium heterospina, LINTON, Fish Com. Rept., 1887, pp. 839–840, pl. XII, figs. 3–5 (not 6).

Some cysts from the peritoneum of the common eel (*Anguilla rostrata*), collected at Woods Holl, Massachusetts, September 2, 1885, contain embryos which agree in the character of the hooks, the best criterion for determining species in these soft-bodied worms, with *R. heterospine*. Two specimens in alcohol:

Measurements of Rhynchobothrium heterospine.

Dimension.	No. 1.	No. 2.
	mm.	*mm.*
Length	3.20	2.54
Breadth of head	.61	.56
Diameter of neck	.30	.27
Length of bothrium	.59	1.00
Length of contractile bulbs	.37	.37
Length of proboscis, approximate	1.25	1.25
Length of longest hooks	.022	0.22

The retractor muscle of the proboscis is attached to the inner wall of the contractile bulb near the anterior end (figs. 6, 7).

It can hardly be inferred that the eel is the true intermediate host of this parasite. This remark may indeed be properly made for many of the larval parasites found in fishes—where they may be in the condition of what Beneden calls xenosites or strangers.

When a blastocyst was removed from its cyst, it was enveloped in a thin hyaline membrane (fig. 3, *h*). After the embryo was removed from the blastocyst, the latter exhibited signs of life for some time, even attaching itself to the bottom of the glass vessel by its smaller end and dragging itself along.

The embryo when liberated from its blastocyst, had the following dimensions, living: Length, 2.1 mm.; breadth of head, 0.49; length of head, 0.35; diameter of neck, 0.21; length of neck from base of bothria to base of contractile bulbs, 0.94; length of contractile bulbs, 0.42.

The retractor of the proboscis attached to wall of contractile bulb near anterior third of bulb.

9. RHYNCHOBOTHRIUM IMPARISPINE, Linton. (Larva.)

(Plate IV, figs. 9–12.)

Rhynchobothrium imparispine, U. S. Fish Com. Rept., 1887, pp. 840–843, pl. XII, figs. 6–9.

Following is a list of finds of a tetrarhynch, which I have identified as *R. imparispine*. The principal criterion used in these identifications has been the nature and arrangement of the hooks on the proboscides,

which, being so remarkable, it hardly seems probable that two distinct species could agree so closely in this particular as I find these specimens to do.

1. Rhynchobothrium collected at Woods Holl.

No.	U.S.N.M. number.	Date.	Host.
1	.....	Aug. —, 1884	Common Flounder (*Paralichthys dentatus*), serous coat of intestine.
2	4772	July 31, 1885	Goosefish (*Lophius piscatorius*), mesentery.
3	4832	July 23, 1886	Tomcod (*Microgadus tomcod*), serous coat of intestine.
4	5461	Aug. 6, 1886	Goosefish, mesentery.
5	4743	Aug. 19, 1886	Mackerel (*Scomber scombrus*), serous coat of viscera.
6	5460	Aug. 10, 1887	Sand Flounder (*Bothus maculatus*), mesentery, etc.
7	5463	.....do	Tautog (*Tautoga onitis*), serous coat of viscera.
8	.....	Aug. 30, 1887	Goosefish, mesentery, etc.
9	.....	July 30, 1889	Sea Bass (*Centropristes striatus*), serous coat of viscera.
10	.....	Oct. 7, 1886	Cod (*Gadus callarias*), collected by S. E. Meek, Block Island.

2. Rhynchobothrium collected by Vinal N. Edwards.

No.	U.S.N.M. number.	Date.	Host.
11	4770	Nov. 3, 1882	From mesentery of *Lophius piscatorius*.
12	5462	Dec. 1, 1885	Peritoneum of *Melanogrammus aeglefinus*.
13	.....	Dec. 16, 1885	Do.
14	4770	Nov. 4, 1886	Mesentery of *Lophius piscatorius*.
15	4770	Oct. 14, 1887	Do.
16	4756	Oct. 24, 1887	Peritoneum of *Acanthocottus aeneus*.
17	4755	Nov. 28, 1887	Peritoneum of *Gadus callarias*.
18	4755	Dec. 24, 1887	Do.
19	4755	June 24, 1888	Do.

This parasite occurs in cysts that are usually pyriform and sometimes attached to the serous membrane by a pedicel. The bothria are very versatile and deeply notched on distal end so as to appear in some instances to be distinct bothria.

Following are extracts from notes made on individual lots, numbers referring to foregoing list:

Numbers 2, 4, 8, 11, 14, 15. From *Lophius piscatorius*. The cysts are subglobular or pyriform; one in lot 11 measured 11 mm. in length and 5 mm. in greatest breadth; hooks on proboscides in No. 15 (fig. 12) not very clearly seen on account of the proboscides being retracted; large stout hooks 0.06 mm. in length and 0.04 in breadth at base. No. 2 (figs. 9–11), freehand sketches from life; cysts pyriform, blastocyst oblong, remaining firmly attached to embryo, when latter is liberated, to form a nutrient sac. The latter is filled with coarse granular parenchyma with fluid refractile bodies. In one lot the hooks in one specimen were sparsely scattered, which may be due to imperfect development.

The peritoneum of each of the three fish examined was filled with transparent subglobular cysts, averaging about 6 mm. in diameter. The blastocysts were nearly globular when at rest, but capable of much change of form by contraction. The embryo could be seen as a

small opaque mass near the surface of the blastocyst. In the walls of the latter were two sinuous vessels which started from the vicinity of the embryo and ran in opposite directions around the periphery of the blastocyst. No. 6 from *Bothus maculatus*. In this the longest hooks, however, are 0.04 mm. in length. Other dimensions of an embryo (alcoholic) are: Length, 6 mm.; breadth of head, 0.94; length to base of contractile bulbs, 4; diameter of neck, 0.47; length of bulbs, 1; diameter of proboscis, exclusive of hooks, 0.08. No. 7 from the tautog. The arrangement and character of the hooks in this also agree exactly with that of the foregoing; the length of the large stout hooks is 0.05 mm. Other dimensions practically the same as in No. 6. No. 5 from the mackerel. The cysts in this lot are of great diversity of shape. Two embryos were examined, and although the proboscides were retracted the characteristic irregular hooks of *R. imparispine* could be seen. The length of the longest hooks seen was 0.04 mm. in one and 0.035, near base of proboscis, in the other. No. 9 from sea bass. Cysts pyriform, blastocysts with embryo situated at one end; proboscides retracted, but hooks correspond with *R. imparispine*.

Nos. 10, 16, 17, and 18 from the cod and Nos. 12 and 13 from the haddock. The cysts are pyriform and in many instances pediceled; in No. 16 there was a cluster of pyriform cysts. When embryos were liberated, the arrangement and character of the hooks proved to be identical with those figured from other hosts and referred to *R. imparispine*.

10. RHYNCHOBOTHRIUM SPECIOSUM, new species.

(Plates IV, figs. 13–14; V, figs. 1–7.)

Rhynchobothrium, sp., LINTON, Amer. Nat., XXI, p. 195, Feb. 1887, pl. X, figs. 1–6.

I venture to give a new specific name to a *Rhynchobothrium* which I have found very commonly infesting the bluefish and not infrequently in a variety of other fish. Although only the larval form is known to me at present, the characters of the bothria, and particularly of the proboscides, are so well defined that one can hardly fail to identify it when specimens in good condition and sufficiently developed are met.

Following is a list of the finds of this parasite which I have recorded in my notes. All except Nos. 9, 10, and 11 were collected at Woods Holl, Massachusetts. Where not otherwise stated, it will be understood that the specimens were found on the serous covering of the viscera or mesentery.

List of specimens.

No.	U.S.N.M. No.	Date.	Host.
1	.....	Aug. —, 1884	Common Flounder (*Paralichthys dentatus*).
2	.....	.....do	Bluefish (*Pomatomus saltatrix*), on ovaries, etc.
3	.....	Aug. 19, 1885	Scup (*Stenotomus chrysops*).
4	4766	July 27, 1886	Garfish (*Tylosurus caribbæus*).
5	5469	Aug. 5, 1886	Bluefish (*P. saltatrix*).
6	4790	.....do	Squeteague (*Cynoscion regalis*).
7	.....	Aug. 19, 1886	Mackerel (*Scomber scombrus*), 20, walls of stomach and intestine.
8	4819	Oct. —, 1886	Moon fish (*Chætodipterus faber*), North Carolina coast, S. E. Meek, collector.
9	.....	.....do	Bluefish (*P. saltatrix*), Massachusetts coast, S. E. Meek, collector.
10	4768	.....do	Squeteague (*C. regalis*), Massachusetts Bay, S. E. Meek, collector.
11	5466	July 26, 1887	Remora (*Echeneis remora*).
12	4753	July 29, 1887	Bluefish (*P. saltatrix*).
13	5471	Aug. 1, 1887	Remora (*E. remora*).
14	5464	July 9, 1889	Bluefish (*P. saltatrix*).
15	5465	July 26, 1889	Do.
16	5470	July 30, 1889	Do.
17	4735	Aug. 17, 1889	Do.

I reproduce, with the omission of many details, the description of this species contained in the article in the "American Naturalist."[1]

Cysts like this—i. e., containing an embryo rhynchobothrium, either of the same or kindred forms—are common in most of the teleostei, and are occasionally found in selachians. In the specimen under consideration (a cyst from the peritoneum of the bluefish) the length was 12 mm., and the breadth in the widest part 6 mm. The cyst was clavate, its walls thin, transparent, and delicate, with yellow granular patches at the larger end. It was easily separable into two hyaline connective-tissue layers, the outer thicker than the inner.

The blastocyst when released from its capsular envelope was white and opaque, but became translucent, with a faint bluish tinge when compressed and viewed by transmitted light. The form, while somewhat variable, is usually club-shaped, much larger at one end than the other, the larger end blunt and rounded. When placed in sea water, it continues in a state of activity for hours. There is no decided locomotion, but a continuous series of movements, consisting of alternate contraction and extension of different parts of the sac-like mass and feeble lateral movements of the smaller end. In this condition the appearance of the blastocyst is that of a thick-walled sac, the walls of which are made up of granular protoplasm, with a thin investing membrane, and filled with clear, highly refractile globular masses. When slight pressure is applied, the embryo may be seen lying in a loose coil in the larger end of the blastocyst. Two sinuous vessels, one on each side, can be plainly seen lying along each side. These unite in the median line at the smaller end. At the larger end they appear to be lost in the common parenchyma. In the immediate vicinity of the embryo the blastocyst is more transparent than in other parts, and the

[1] February, 1887, pp. 199, pl. x.

embryo appears to be held in place by a limiting membrane, which lines the blastocyst and surrounds the embryo. When considerable pressure is applied, the embryo is forced through the walls of the larger end of the blastocyst, with which it no longer retains vital connection.

The irritability and contractility of the blastocyst continue for several hours after the embryo has been removed. The embryo when removed from the blastocyst was quite active, its length about 24 mm., although capable of considerable variation both by contraction and extension. The bothria are two in number, oblong-elliptical, widely divergent behind, approaching but not uniting in front; emarginate on posterior border and obscurely two lobed (alcoholic specimens show a distinct longitudinal median ridge); edges free, thin, and mobile. Length of bothria, measured while somewhat flattened under compressor, 2.23 mm.; breadth of head, 2.72. Proboscides, four, very long, slender, cylindrical, and armed with recurved hooks of different sizes. The proboscides, in this instance, were not entirely everted, but by counting the series of hooks which were exposed, and allowing for the part which was inverted, which could be plainly seen through the transparent walls of the proboscis, the result was about one hundred series of hooks arranged in spirals. The spirals are nearly 0.05 mm. apart, and the proboscides about 4.8 in length. There are about fifteen longitudinal rows of hooks. These rows do not coincide exactly with the axis, but make about one and a half turns around it from base to apex. Their arrangement is shown in the accompanying sketch (Plate V, figs. 1–6).

The proboscis sheaths are long and spiral. A contractile ligament was clearly defined in each and could be traced out into the proboscis, where it appeared as a tubular band containing a fluid in which floated a few granules. Toward the end this tubular ligament merged imperceptibly in the proboscis, and the fluid interior with granules became the exterior of the proboscis inverted, with, at first, small and scattered rod-like hooks, and, toward the apex of the inverted proboscis, with normal hooks attached to the inner parietes.

The front ends of the contractile bulbs lie about 10 mm. back of the apex of the head; length 2.46, and breadth 0.24. The thick walls are composed of diagonal muscular fibers which interlace, making angles of about 70 and 110 degrees with each other. These organs act much as the bulb of a syringe. By their contraction the fluid contents is forced into the proboscis sheaths and proboscides. The column of fluid thus forced into the proboscides causes them to unroll like the finger of a glove that has been turned in. The contractile ligament, noticed above, extends the entire length of the proboscis sheath and is attached to the inner parietes of the bulb. By its contraction the proboscis is invaginated from the apex. When the embryo was first liberated, the proboscides were entirely retracted; when, however, pressure was applied, they unrolled. In this condition the proboscides

of the living worm are very beautiful objects, being quite transparent, while the chitinous hooks have a brilliant vitreous luster. When fully extended, the proboscides throw themselves into graceful spiral curves. When the pressure is released, if the worm is uninjured, they are apt to be withdrawn.

The tubular neck, when flattened under the compressor, presents the following features: The center surrounding the proboscis sheaths is filled with large irregular granular masses, closely packed together. Outside of this inner core is a layer of longitudinal muscles, and outside of this again a layer of vascular tissue, in which the reticulated vessels of the water vascular system can be plainly seen. Outside of the vascular area, and forming the outer coat of the neck, is a layer of dense tissue in which transverse fibers could be distinguished.

The water vascular system consists of a network of vessels in the borders of the bothria which connects with large sinuous vessels in the center of the head, and, together with these, with the reticulated subcuticular vessels of the neck. Back of the contractile bulbs the system is represented mainly by two pairs of vessels which lie in two sinuous curves near each lateral margin of the embryo. One of these vessels was much larger than the other and ended in a bulbous enlargement.

Behind the contractile bulbs the body has the appearance of an elongated sac, filled with granular parenchyma, but with the retractile bodies much smaller than those in the blastocyst. The posterior end terminates in a papillary button-like process, which is retractile and covered with a dense coat of minute, straight, hair-like bristles.

I add a few extracts from notes on some of the foregoing lots. The general account already given was based on specimens from the bluefish.

No. 3. Dimensions of specimen, alcoholic, from scup: Length, 27 mm.; length of head and neck, 13; length of bothria, 2; breadth of bothrium, 1.6; breadth of neck, 1.5; thickness of neck, 1; diameter at contractile bulbs, 2.5; diameter behind contractile bulbs, 1.7; tapering from behind contractile bulbs to posterior tip, which is 0.5 mm. in diameter. The hooks agree exactly with those on larva from the bluefish.

No. 10. Cyst from liver of squeteague: Length 30, mm.; diameter of first third of length, 3.5, tapering thence rather abruptly to posterior end, 1.5. Embryo coiled in larger end; length, estimated, 13.5. Hooks agree exactly with type; length of longer ones, 0.53.

No. 9. Cyst from abdominal cavity of moonfish: Long pyriform, length, 20 mm.; greatest diameter, 4.5; embryo coiled in anterior fourth; length of embryo, 12; of head and neck, 4.6; diameter of neck, 1.5; length of bothrium 1.5, and breadth of bothrium 1.25. Bothria elliptical with posterior emargination and median longitudinal elevation; neck cylindrical with a few transverse wrinkles; hooks agree with type—largest 0.05 mm. in length.

Nos. 11 and 13. From serous covering of viscera of remora. These agree exactly with type. The cyst in No. 11 was dark reddish brown, translucent except at small end, which was almost black. Length, 36 mm. and greatest diameter 5; length of blastocyst 26, and greatest diameter 4.5; very active and changeable. After lying overnight in sea water, the blastocyst having become quiescent, the embryo was set free. It was active and varied in length from 20 to 25 mm. Further dimensions were: Length of head and neck, 9 mm.; length of contractile bulbs, 2.7; diameter of contractile bulbs, 0.32; length of proboscides, approximate, 4.8; diameter of proboscides, 0.12.

Proboscides very long, slender, and graceful, having tendency to coil up; larger hooks on inner side of coil, smaller on outer side; arrangement of hooks typical.

No. 1. From common flounder, on viscera, typical. Edges of bothria often reflected and face of bothrium hollowed out. The posterior emargination and median ridge are best seen in alcoholic specimens.

11. RHYNCHOBOTHRIUM ATTENUATUM, Rudolphi.

(Plate V, figs. 8–11.)

Rhynchobothrium attenuatum, DIESING, Syst. Helm., I, p. 568; Revis. d. ceph. Ab. Param., p. 307.

No. 5459, U.S.N.M., parasites of swordfish (*Xiphias gladius*).

1. Off Marthas Vineyard, Massachusetts, July 25, 1887, numerous specimens from peritoneum (No. 4761, U.S.N.M.).

2. Three specimens collected by Professor W. Libbey, schooner *Grampus*, July 24, 1889.

3. Sixteen specimens, No. 4715, U.S.N.M., September 21. Trawl line U. S. Fish Commission from outside stomach and intestine of swordfish.

4. Twenty specimens, No. 4714, U.S.N.M., from outside stomach of swordfish.

These worms agree with Diesing's descriptions of this species, and resemble Leuckart's[1] figure of his *Bothriocephalus claviger*, which is placed by Diesing under *T. attenuatus*, Rudolphi, in his Systema Helminthum, but transferred to the genus *Rhynchobothrium* in the Revision, with the following description: "Head ovate-conical, with conical lateral bothria, bilocular by a longitudinal septum. Proboscides straight, clavate. Neck very long, decreasing behind, sometimes transversely rugose, joints of the body papilliform."

These larvæ are grub-like in appearance, the proboscides short and thick, the hook-bearing portion being but little longer than broad. Hooks of different shapes, but differing gradually from one part of proboscis to another—better shown in sketch than in a written description. The proboscides are in pairs at the apex of the bothria; the latter are on the sides of the head, which correspond with the flat surfaces of the neck.

[1] Zool. Bruchst., I, pp. 51, 62, pl. II, fig. 32.

I append the following extracts from notes made on the above several lots:

1. Length of one in fresh water, 64 mm.; greatest breadth, near head, 10; least breadth, 5; constantly altering its shape. Another, in salt water, measured 103 mm., and another 130. Length of proboscis, 1.58; breadth of proboscis, 1.16; length of hooks, 0.018; length of contractile bulb, 4.73; breadth, 0.88.

2. Specimens had been hardened in Perenyi's fluid. Largest, length, 72 mm.; greatest breadth, 7. Another, length, 56; greatest breadth, 8.

3. Of nearly uniform size, alcoholic specimens, length, 50 mm.; breadth, 6.

Three specimens of *T. bicolor* were found in this lot with their heads penetrating the bodies of *R. attenuatus*.

4. The largest specimen in this lot (alcoholic) had the following dimensions: Length, 62 mm.; breadth of head, 5.5; thickness of head, 4; greatest breadth, 9.

A large cyst was found in this lot, 37 mm. long, 36 broad, and 12 thick, which contained a coiled larva, apparently the same as the free larvæ, but it had undergone a kind of waxy degeneration to such a degree as to obliterate specific characters. This cyst had a pedicel about 60 mm. in length.

A few other waxy cysts, smaller than the above, were included in the lot.

12. OTOBOTHRIUM DIPSACUM, new species.

(Plate VI, figs. 1–5.)

I record under the above new specific name the following notes made on a unique tetrarhynch embryo from a cyst in a bluefish (*Pomatomus saltatrix*), (No. 4794, U.S.N.M.).

The cyst was oval, about 12 mm. in the longer and 6 in the shorter diameter, and consisted of an outer transparent coat, separable with needle points into two layers, and an almost opaque, granular, dirty-yellow coat, which appeared to be lined with a very delicate transparent membrane. The blastocyst when liberated was found to be pear shaped, translucent white, beautifully reticulated, 8.5 mm. long, 6 in diameter at the larger end, and tapering through an offset to a blunt point. At the middle of the base there was a puckered appearance, due, apparently, to radiating contractile fibers. The blastocyst was constantly undergoing changes of form, which had the appearance of being caused by spasmodic contraction of the semifluid parenchyma with which it was abundantly supplied. When the embryo was liberated from the blastocyst, it had the following dimensions, slightly distorted by compression:

Dimension of Octobothrium dipsacum.

Measurements.	Living.	Alcoholic.
	mm.	*mm.*
Length	5.00	3.00
Length of bothrium	1.80	1.00
Length of contractile bulbs	2.00	1.40
Diameter of contractile bulbs	.32	.18
Length of proboscis (approximate)	2.60	1.30
Diameter of proboscis, exclusive of hooks	.12	.12
Diameter of proboscis, including hooks	.22	.21
Length of longest hooks	.05	.05

The proboscides were not seen fully extended, but so far as unrolled they were clavate.

The bothria were four, in pairs. Each bothrium is provided on its posterior edge with a small cup-shaped organ, about 0.01 mm. in diameter, which is eversible. When slight pressure was applied, these organs were everted, when they appeared as small tubercles covered with exceedingly fine, short, stiff-looking bristles, about 0.002 mm. in length.

Behind the contractile bulbs, at the posterior end of the embryo, is a short papillary projection, covered with very fine downy bristles.

The neck of the living embryo is translucent, and has the following characters in optical section: There is first an outer granular layer 0.002 mm. thick, next a layer of transverse fibers 0.07 thick, next a layer of longitudinal fibers 0.025 thick. Within is a central space filled with a granular parenchyma containing numerous refractile bodies. In this central space also the branching and anastomosing vessels of the water vascular system and the proboscis sheaths with their retractile muscles can be made out.

The arrangement of the hooks on the proboscides is characteristic (figs. 2, 3), in that each has a longitudinal line toward which the shorter diagonal rows of hooks converge on each side. Near the base of the proboscides, where the hooks are somewhat scattering, from six to ten hooks to a row could be counted on each side of the horizontal line, under favorable circumstances. More than twice that number could be counted in the rows nearer the apex of the proboscis.

18. Genus TETRARHYNCHUS.

(Plate VI, figs. 6–10.)

I group together under this head a number of larvæ from a variety of hosts, some of which undoubtedly belong to this genus, but which I am unable to identify certainly with any adult form; others may not belong to the genus at all, notably numbers 7 to 11.

1. Small cysts from serous coat of stomach of the dusky shark (*Carcharinus obscurus*) (No. 5480, U.S.N.M.), twice in August, 1884, and again, July 25, 1887, Woods Holl, Massachusetts.

Dimensions of alcoholic specimen.—Length of cyst, 0.47; diameter of cyst, 0.27; length of blastocyst, 0.3; diameter of blastocyst, 0.12; length of contractile bulbs, 0.086; diameter, 0.043; diameter of proboscis, about 0.02; hooks very small, about 0.01 in length.

Proboscides slender, hooks strongly recurved. Possibly young stage of *Tetrarhynchus robustum*, Linton.

2. Minute cysts from intestinal walls of hammerheaded shark (*Sphyrna zygaena*) (No. 5479, U.S.N.M.), Woods Holl, Massachusetts, July 28, 1886. Length of blastocyst, 0.56 mm.; diameter at larger end, 0.45, tapering to a blunt point at the smaller end. Embryo a small granular mass, near larger end 0.09 mm. in diameter.

3. Small cysts from the cero (*Scomberomorus regalis*) (No. 5494, U.S.N.M.), collected at Woods Holl, Massachusetts, August 12, 1886; July 30, 1887; August 9 and August 13, 1889.

Dimensions of alcoholic specimen slightly compressed.—Length of cyst, 1 mm.; breadth of cyst, 0.75; length of larva, 0.33; length of bothrium, 0.13; breadth of head, 0.17; length of contractile bulbs, 0.09; breadth, 0.066; hooks very minute, about 0.005 in length.

Possibly young stage of *Tetrarhynchus tenue*, Linton (No. 4819, U.S.N.M.).

4. *Tetrarhynchus chætodipteri*, from abdominal cavity of *Chætodipterus faber*, North Carolina coast, October, 1886, collected for the United States Fish Commission by S. E. Meek, Fulton Market, New York. The cysts were in small clusters in the abdominal cavity of the host. One cluster was 12 mm. long and 7 broad—all the cysts small; a typical one measured 1.7 mm in length and 0.88 in breadth.

Dimensions of cyst and embryo.—Length of cyst, 1.3 mm.; breadth, 0.7; length of embryo, 1.14; length of bothria, 0.38; length of contractile bulbs, 0.31 diameter of bulbs, 0.15; diameter of proboscis, exclusive of hooks, 0.017; length of longest hooks, 0.011. The inner face of the proboscis bears extremely small bristle-like hooks. The outer face bears, for the most part, rather stout, recurved hooks (Plate VI, fig. 9.).

5. Cysts from stomach wall of the sting ray (*Trygon centrura*) (Nos. 5477, 5478, 5481, U.S.N.M.), collected at Woods Holl, Massachusetts, August 14, 1885, July 27, 1886, July 18, August 3 and 10, 1887, and July 24, 1889.

The cysts are small and contain small subconical blastocysts, which have a rudimentary embryo near the larger end.

Dimensions of alcoholic specimens.—Length of blastocyst, 1.44 mm.; diameter at larger end, 0.94; diameter at smaller end, 0.16; length of embryo, 0.144; diameter of embryo, 0.08. Calcareous bodies are present in the blastocysts, and some cysts were found in which the contents had degenerated. Two cysts, belonging one to each of the first two lots, are larger than dimensions given above—3.5 mm. in length. For the others the dimensions given are typical.

In all cases the embryo was too rudimentary to allow of even approximate identification.

6. Cysts (Nos. 4838, 4822, U.S.N.M.) from stomach wall of the dogfish (*Mustelus canis*), collected at Woods Holl, Massachusetts, July 22, 1886, and July 22 and 25, 1887. In most cases these cysts are small with rudimentary embryos, in which the proboscides are too rudimentary to be of value in determining specific characters. A typical cyst measured 1.5 mm. in diameter and contained a blastocyst 1.04 mm. in length and 0.8 broad.

In one lot embryos were obtained from blastocysts (alcoholic specimens), which gave the following measurements: Length, 1.3 mm.; diameter, 1.1; diameter of proboscis, exclusive of hooks, 0.034; diameter, including hooks, 0.06; length of hooks, 0.019 (Plate VI, figs. 6, 7).

These larvæ bear a strong resemblance to *R. robustum*, Linton.

7. Cysts from intestinal wall of common skate (*Raia erinacea*) (No. 5482, U.S.N.M.), Woods Holl, Massachusetts, August, 1884, twice. No embryos. Cysts in first lot filled with amber-colored waxy secretions.

The second find consisted of an elliptical cyst in the liver, 3½ by 2½ mm. in diameter, and about 1 thick; reddish brown. Contained roundish granular masses from 0.16 to 0.40 mm. in diameter. Cyst had a pedicel which contained quantities of blood corpuscles of the host. This may be a sporocyst.

8. Small cysts from gill of goosefish (*Lophius piscatorius*) (No. 5476, U.S.N.M.), Woods Holl, Massachusetts, July 18, 1885.

These cysts were from 1 to 2 mm. in diameter, contained masses of carbonate of lime, and could not be identified.

9. Cysts from serous coat of intestine of billfish (*Tetrapturus imperator*) (No. 5501, U.S.N.M.), Woods Holl, Massachusetts, July 31, 1895.

These cysts were filled with chocolate-colored waxy secretions. They were evidently caused by the presence of a parasite which had undergone complete degeneration of tissue.

10. Cysts from peritoneum of flounder (*Pseudopleuronectes americanus*) (No. 5502, U.S.N.M.), Woods Holl, Massachusetts, August 23, 1886, and August 10, 1887. These cysts are from 2 to 3 mm. in length and look like tetrarhynchus cysts. Many of them are entirely or partly degenerate, containing much carbonate of lime, and in no case could the exact nature of the cyst be made out.

11. No. 4837. Cysts from peritoneum of butterfish (*Stromateus triacanthus*), Woods Holl, Massachusetts, July 23 and August 24, 1887. Small cysts less than 2 mm. in length, which contained an elongated blastocyst (?) from 1 to 2.4 mm. in length. Some of these had an aperture at larger end. The cysts had yellowish granular walls, and inclosed the blastocyst (?), which was itself twisted in a transparent membranous sac. The chyle of the intestine of the first lot was found to contain numerous examples of these embryos—i. e., identical with the blastocysts (?) above.

14. TETRARHYNCHUS BISULCATUM, Linton.

(Plate VI, figs. 11–15.)

Rhynchobothrium bisulcatum, LINTON, U. S. Fish Com. Rept., 1886, pp. 479–486, pl. IV, figs. 9–23; U. S. Fish Com. Rept., 1887, pp. 857–861, pl. XIV, figs. 10–12, and pl. XV, fig. 1.

I have found a larval *Tetrarhynchus*, which I refer to this species, on a number of occasions and in a variety of hosts.

Tetrarhynchus bisulcatum, collected at Woods Holl, Massachusetts.

No.	U.S.N.M. number.	Date.	Host.
1	.....	July —, 1884	Common flounder (*Paralichthys dentatus*), stomach wall.
2	4826	Aug. —, 1884	Squeteague (*Cynoscion regalis*), stomach wall.
3	4834	July 23, 1886	Do.
4	.....	July 30, 1886	Do.
5	4823	July 14, 1887	Torpedo (*Tetranarce occidentalis*), in pylorus.
6	.....	Aug. 24, 1887	Flounder (*P. dentatus*), stomach wall.
7	.....	Aug. 30, 1887	Scup (*Stenotomus chrysops*), stomach wall.
8	.....	Sept. 2, 1887	Flounder (*P. dentatus*), stomach wall.
9	.....	July 16, 1889	Do.
10	.....	July 20, 1889	Squeteague (*C. regalis*), stomach wall.
11	.....	July 27, 1889	Do.
12	.....	Aug. 16, 1889	Rudder-fish (*Seriola zonata*), stomach wall.
13	.....	Aug. 19, 1889	Squeteague (*C. regalis*), stomach wall.
14	.....	Aug. 27, 1889	Flounder (*P. dentatus*), stomach wall.
15	.....	Aug. 28, 1889	Do.

There were many finds from squeteague not included in the above list. The favorite lodgment of this parasite is between the submucous and mucous layers of the stomach. I have found it very abundant in the squeteague at Woods Holl, Massachusetts, and have seldom examined one of these fish without finding numerous examples of encysted tetrarhynchs in the stomach walls.

The specimens from the squeteague appear to be typical scoleces of *T. bisulcatum*. An alcoholic specimen yielded the following measurements: Length of scolex, 1.6 mm.; diameter of head, 0.94; length of contractile bulbs, 0.42; diameter of proboscis, including hooks, 0.053; length of longest hooks, 0.023.

The cysts are small, oval; the blastocyst is also oval and is filled with semifluid parenchyma with retractile granules. The embryo lies at one end with the head pointing outward. It consists of the bothria and short conical neck, the latter fitting over a very short terminal part like a collar.

A specimen from the flounder agrees, in general appearance and in character of hooks, with type (alcoholic specimen): Diameter of proboscis, including hooks, 0.062 mm.; length of hooks, 0.019.

The specimen from the rudder-fish has a tumid neck, making it short fusiform instead of conical, the usual shape.

The specimen from the scup agreed in general appearance. The proboscides were retracted, only a few basal hooks showing. These were small, 0.015 mm. in length.

The specimen from the torpedo was found in the pyloric division of the stomach; only the scolex present. It presents some differences from typical scoleces of *T. bisulcatum*, the proboscides being stouter than usual for that species. The proboscides were retracted and only the short hooks at base of proboscis were seen at first; their length was 0.014 mm. The specimen was then made transparent with oil of cloves and the hooks found to agree in size and shape with those of *T. bisulcatum* (figs. 13, 14) (No. 4834, U.S.N.M.).

15. TETRARHYNCHUS ERINACEUS, Beneden.

(Plate VII, figs. 1–8.)

Tetrarhynchus erinaceus. BENEDEN, Mem. Vers. Intest., pp. 128–131, 367, pl. XVIII; Les Pois Belg., pl. V, fig. 12; pl. VI, fig. 3.—OLSSON, Lund's Univ. Arsskrift, III, p. 50, pl. II, figs. 42–44.

A species which has hooks that bear a strong resemblance to those of *Rhynchobothrium imparispine*, Linton, but with a cystic habit much like that of *Synbothrium filicolle*, occurs twice in my collection and once in the United States National Museum collection:

Tetrarhynchus erinaceus.

No.	U.S.N.M. number.	Date.	Host.
1	4824	Aug. —, 1884	Squeteague (*Cynoscion regalis*), outside of ovary.
2	4830	July 29, 1889	Bluefish (*Pomatomus saltatrix*), serous coat of viscera.
3	4828	.....	Squeteague (*C. regalis*), serous coat of viscera.

The first and last are encysted blastocysts of the type of *Synbothrium* (fig. 1).

Dimensions of specimens from lot No. 1 (alcoholic).—Length of blastocyst, 40 mm.; length of anterior division, 2.5; diameter of anterior division, 2; average diameter of posterior division, 1.5; breadth of head of embryo, 0.76; length of thick, strong hooks, 0.09; length of small, slender hooks, 0.015; length of small hooks, 0.008. Color of posterior division, opaque white; of anterior division, yellowish white.

No. 3 consists of a single blastocyst, same type as No. 1. Dimensions, alcoholic specimen: Length, 22 mm.; length of anterior part of blastocyst, 3; diameter of same, 2.5; diameter of posterior part, 1.5; breadth of head, 0.72; diameter of neck, 0.5; length of large stout hooks, 0.06 to 0.08; length of small hooks, 0.01 to 0.03; diameter of proboscis, exclusive of hooks, 0.1; length of embryo proper, 6; length of contractile bulbs, 1.8. Posterior part of blastocyst, white; anterior, brownish yellow. The hooks have the following arrangement: Two longitudinal rows of large, stout, strongly recurved hooks, flanked on each side by two rows of smaller and slenderer hooks, also strongly recurved; these again by two rows of slender hooks, those in the inner row sharp-pointed, those in the outer row flat with truncate or notched tips. These ten rows of large hooks cover a little more than half the

circumference of the proboscis. The remainder of the surface is covered with minute hooks placed close together. These minute hooks also extend for a short distance between the spirals of larger hooks, where they are a little larger than they are on the outer surface of the proboscis. The larger spirals are about 0.09 mm. apart.

No. 2 (fig. 6), sketch of alcoholic specimen, embryo detached from blastocyst to which it was firmly adherent; from *Pomatomus saltatrix*. The bothria are doubtless distorted. The sketch was made with the aid of a camera lucida, and represents exactly the appearance of the embryo. It is quite different from other embryos, having the characteristic hooks of *R. erinaceus*. Figure 7 is a sketch of a portion of a proboscis of this specimen. It will be seen that it agrees with the specimen from *C. regale* in every essential particular. Dimensions of this interesting alcoholic specimen are as follows: Length, 2 mm.; breadth of head, 1.08; diameter of neck, 0.34; length of contractile bulb, 1; diameter of proboscis, excluding hooks, 0.09; length of stout hooks, 0.09; breadth of same, middle of hook, 0.038; length of long, slender hooks, 0.106; length of shortest hooks, 0.005.

16. TETRARHYNCHUS ELONGATUS, Wagener.

(Plate VII, figs. 9–12.)

Anthocephalus elongatus, WAGENER, Nov. Act. l. c. 57 and 81, pl. XVII, fig. 217; XVIII, fig. 218.—DIESING, Revis. d. ceph. Ab. Par., p. 313.—OLSSON (*Tetrarhynchus*, statu scolecis), Lund's Univ. Arsskrift, IV, p. 9, pl. III, fig. 63.—LEIDY, Proc. Acad. Nat. Sci. Phil., 1890, p. 282.

Under this title, I notice some larvæ of tetrarhynchus from the liver of the sunfish (*Mola rotunda*).

The specimens (No. 5484, U.S.N.M.) were obtained from the United States Fish Commission, having been collected off Marthas Vineyard, Massachusetts, September 10, 1886, and sent to me for identification. I therefore have seen them only in the condition of alcoholic specimens. The specimens were still in the liver, which was, in places, tunneled out by the parasites, and the latter were much broken, so that none of them could be taken out entire.

The blastocysts are subspherical at the anterior end, which contains the head and neck of the embryo. The posterior end is elongated into a slender cylindrical body. When the head and neck portion is liberated from the anterior end of the blastocyst, it still remains in connection with the posterior slender part of the blastocyst.

The diameter of the rounded anterior portion of one blastocyst was 5 mm. The posterior slender portion, so much of it as was extracted from the liver of the host, measured 65 mm. in length and 1.5 in diameter.

One of the globular enlarged portions of a blastocyst was placed in glycerine and left until thoroughly softened, then opened carefully, and the embryo uncoiled. It was found to be continuous with the

slender posterior part, all being inclosed in a thin transparent covering. No sign of segmentation was observed.

The most characteristic feature is the prolongation of the anterior ends of the bothrial lobes to form the unarmed basal portion of the proboscides.

A specimen, slightly compressed, yielded the following measurements: Length of bothria, 2.2 mm.; breadth of head, 1.6; length of anterior prolongation of bothria, 1.8; diameter of same, 0.34; length of proboscides, estimated from retracted organ, 6.75; length of contractile bulbs, 2.4; diameter of same, 0.34; length of longest hooks, 0.12.

Hooks were seen only on the retracted proboscides. They are of very diverse shapes, a few of which are shown in figure 12. The arrangement could not be made out exactly. There is a cluster of small bristle-like hooks near the apex (*a*), preceded at extreme tip by a few large horn-shaped hooks (*b*). The most abundant type is long, slender, and slightly curved (*d*). The type (*e*) constitutes three or four longitudinal rows throughout the length of the proboscis.

17. TETRARHYNCHUS BICOLOR, Bartels.

(Plate VIII, figs. 1–6.)

Bothriocephalus bicolor, BARTELS, Diesing, Syst. Helm., I, p. 608.
Tetrarhynchobothrium bicolor, DIESING, Revis. d. ceph. ab. Par., pp. 316, 317.

I refer to this species five different lots of larvæ of tetrarhynchus from four species of fish.

1. From the dolphin (*Coryphæna hippurus*) (No. 5483, U.S.N.M.). The specimens in this lot were collected August 13, 1885. The fish had been taken on the Gulf Stream a day or two before: Numerous on peritoneum and mesentery.

2. (No. 4820, U.S.N.M.) From the swordfish (*Xiphias gladius*), off Marthas Vineyard, Massachusetts, July 25, 1887: three specimens from peritoneum.

3. (No. 4817, U.S.N.M.) From the dusky shark (*Carcharhinus obscurus*), Woods Holl, Massachusetts, August 12, 1887: one specimen adhering to mucous membrane in pylorus.

4. (No. 4825, U.S.N.M.) From the tiger shark (*Galeocerdo tigrinus*), Woods Holl, Massachusetts, August 14, 1889; five specimens from stomach.

5. (No. 4829, U.S.N.M.) From the swordfish, peritoneum and mesentery; four specimens. Label reads: "September 21, Trawl line, U. S. Fish Commission."

These specimens present considerable difference in size and general appearance of the scoleces, but apparently are absolutely identical in the arrangement of hooks on the proboscides. The character of the proboscides being so peculiar, particularly the nature of the hooks on the base of the proboscis, that where, as in these cases, only the

scoleces are available, I do not feel justified in referring them to different species.

The description of this species given by Diesing is:

Head oblong, cylindrical, violaceous, with four narrow oblong bothria immersed in the head, transversely rugose. Proboscides very slender and short. Neck cylindrical. Body very short, articulated, posteriorly rounded. Genital aperture in median furrow of body.

I must confess to no small degree of difficulty in the classification of these forms, the descriptions of *T. rugosum*[1] and *T. bicolor* applying equally well. Besides, there is a great diversity of form in the scoleces themselves, so that the difficulty of classification is not lessened by referring them to different species.

The specimens from *Coryphæna hippurus* were found, some encysted and some free, in the peritoneum and mesentery of their host. I have no mention of color in my notes made at the time of collection. My recollection is that they were the ordinary yellowish white, so common among allied forms. The arrangement of the hooks on the proboscides agrees with that shown in figures from Carcharias: About seven hooks visible in a spiral on one side near middle of proboscis, about six near apex, and about eight near base, while at the base are the characteristic uncinate plates shown in the sketch; length of proboscis, about 1 mm. The alcoholic specimens vary in length from 4 to 8 mm., and in shape from ovate to oblong-linear, according to state of contraction: usually corrugated, though not always, some of the smaller nearly smooth. The larger specimens show distinct bothria.

In the specimens for *Xiphias gladius*, the proboscides, while relatively more slender than in those from Coryphæna, the arrangement and character of the hooks appear to be identical. The bothria are very indistinct, elongated, narrow, parallel, giving to the larva a striated appearance. Dimensions of one alcoholic specimen: Length, 6 mm.; diameter, 1.25; length of proboscis, approximate, 0.56; length of proboscis sheath, about 1; diameter of proboscis at base, exclusive of hooks, 0.08; at apex, 0.07. In one of the lots from the swordfish three of the larval *T. bicolor* were found with their proboscides penetrating the tissues of *Rhynchobothrium attenuatus*, with which they were associated.

Length of living specimen from *Xiphias gladius*, 10.5; neck inclosing short tail-like part by a collar; color of living specimen, yellowish white. The specimen from the dusky shark was purple red, adhering to pyloric division of stomach. The stomach wall was locally inflamed where this parasite was attached. There was also another ulcerated spot in the mucous membrane near by.

In life the greater part of the specimen was a deep purple red. The anterior end and the posterior behind the bothria were a few shades lighter.

[1] Diesing, Revis. d. ceph. ab. Par., p. 316.

The specimen was quite active when first removed: Length, 7 mm.; diameter in front, 2; diameter middle, 2.5; diameter posterior end, 1.5; diameter of posterior appendage, beginning of strobile, 0.5.

In the alcoholic specimen a little more than the middle third was dark brown, the two ends were yellowish white. Length of proboscis, 1 mm.; diameter of proboscis, exclusive of hooks, at base, 0.11; apex, 0.05; length of contractile bulbs, 1; length of longest hooks, 0.03. For character of hooks see figs. 5, 6.

I have no color notes on the specimens from the tiger shark, and infer that they were the usual yellowish white of most entozoa. The arrangement and character of the hooks agree with those figured for specimens from dusky shark. Dimensions of alcoholic specimen: Length, 5 mm.; maximum diameter, 1.4; length of proboscis, 1; diameter at base, 0.10; near middle, 0.08, including hooks; length of ordinary hooks, 0.026.

18. SYNBOTHRIUM FILICOLLE, Linton.

(Plate VIII, figs. 7–12.)

Syndesmobothrium filicolle, LINTON, U. S. Fish Com. Rept., 1887, pp. 861–862, pl. XV, figs. 2–4.

Tetrarhynchobothrium (larva), Amer. Nat., Feb., 1887, p. 199, pl. X, figs. 7–11.

Synbothrium scolex, HILL, Proc. Linn. Soci. New South Wales (1894), IX, pp. 75–82, pl. V, figs. 14–19.

I have found this parasite in its larval condition—i. e., embryo and blastocyst encysted—frequently and in a variety of hosts, the most usual host being the bluefish (*Pomatomus saltatrix*).

Following is a list of hosts in which I have found this worm. The list also comprises most of the finds of the parasite that I have made; all collections except No. 9 made in the vicinity of Woods Holl, Massachusetts:

Synbothrium filicolle.

No.	U.S.N.M. number.	Date.	Host.
1	5495	Aug. —, 1884	Bluefish (*Pomatomus saltatrix*), serous covering of stomach, etc.
2	4824	.....do	Squeteague (*Cynoscion regalis*), outside of ovary.
3	.....	.....do	Squeteague (*Cynoscion regalis*), serous covering of viscera.
4	4809	.....do	Bluefish (*Pomatomus saltatrix*), on stomach and intestine.
5	.....	.....do	Bluefish (*Pomatomus saltatrix*), on viscera.
6	4831	July 24, 1886	Dogfish (*Mustelus canis*), muscular coat of stomach.
7	5490	Aug. 5, 1886	Bluefish (*Pomatomus saltatrix*), serous covering of viscera.
8	5486	Aug. 12, 1886	Cero (*Scomberomorus regalis*), on stomach, liver, etc.
9	5485	Oct. —, 1886	Bluefish (*Pomatomus saltatrix*), mesentery, etc., collected by S. E. Meek, Fulton Market, New York.
10	5992	July 27, 1887	*Pomolobus mediocris*, serous covering of viscera.
11	5496	July 29, 1887	Bluefish (*Pomatomus saltatrix*), serous covering of viscera, and between mucous and submucous coats of stomach.
12	5491	July 30, 1887	Cero (*Scomberomorus regalis*), on viscera.
13	5493	Aug. 1, 1887	Sting Ray (*Trygon centrura*), stomach wall.
14	5489	Aug. 6, 1887	*Lobotes surinamensis*, serous covering of viscera.
15	.....	Aug. 8, 1887	Dogfish (*Mustelus canis*), stomach wall.
16	4810	Aug. 10, 1887	*Trygon centrura*, stomach wall and spleen.
17	4813	Sept. 2, 1887	Common Flounder (*Paralichthys dentatus*), stomach wall.
18	.....	July 9, 1889	Bluefish (*Pomatomus saltatrix*), serous covering of viscera.
19	.....	July 15, 1889	Bluefish (*Pomatomus saltatrix*), on liver, spleen, etc.
20	5488	July 27, 1889	Bluefish (*Pomatomus saltatrix*), serous covering of viscera.
21	4792	July 29, 1889	Caballe (*Scomberomorus cavalla*), serous covering of viscera.
22	.....	Aug. 19, 1889	Cero (*Scomberomorus regalis*), serous covering of viscera.
23	5487	Aug. 20, 1889	*Scomberomorus maculatus*, serous covering of viscera.
25	4808	——, 1883	Squeteague (*Cynoscion regalis*), on viscera (No. 898 U.S.N.M.), collected by R. S. Tarr.

In No. 11 of the above list thirteen specimens of bluefish were examined. In Nos. 18, 19, 20, and 23 there were forty-four fish examined. Cysts containing larval Tetrarhynchidæ are rarely absent from the bluefish.

The hooks as represented in figs. 9, 10 are quite different from those heretofore published for this species. The specimen described in the United States Fish Commission Report for 1889 had the proboscides retracted so that only a few hooks lying near the base of a proboscis could be distinctly seen. The most distinctive feature of the proboscides of this species is the relatively long, slender, and nearly straight hooks, which are the predominating kind, and in certain parts of the proboscis the only kind. Most of the long slender hooks, when seen under favorable conditions, with proper enlargement, are seen to be notched at the end, a feature which is characteristic of this worm. This feature is easily overlooked, and I have repeatedly thought I had found embryos which did not possess it, but upon a careful examination of an everted proboscis, I have never failed to find hooks with their extremities notched.

I reproduce here, with some slight alteration, my account of this worm given in an article published in the "American Naturalist.[1]"

Another form of cyst I will notice briefly and illustrate by an embryo taken from the surface of the liver of the cero (*Scomberomorus regalis*). This cyst is long and slender, about 10.5 mm. in length and 1.5 in diameter, yellowish, opaque, but broken in places so as to show the outline of the blastocyst.

The blastocyst, which is set free when the walls of the cyst are ruptured, is long and slender, with a neck-like constriction at one end. The head part thus set off is very changeable in form, expanding, contracting, moving up and down and from side to side, and rotating on the constricted neck. The longer part or body of the blastocyst also undergoes much change of form by irregular contraction and expansion, but these movements take place more slowly than in the head. The color is ivory white, slightly translucent when extended. When compressed, the embryo is discovered lying in a coil in the head of the blastocyst. The parenchyma of the head part is now seen to be much coarser than that of the body part, the coarseness being due to the presence of numbers of large, oval, refractile fluid spaces. The parenchyma of the body is dense and finely granular, with smaller retractile masses than those in the head part. When the head part of the blastocyst is broken open, the embryo is released, but instead of separating from the blastocyst, as in the case of an embryo *Rhynchobothrium*, the blastocyst remains attached to the scolex much like the cystocercus of *Tænia*. The method of release, however, is quite different from that of the cystocercus of most Tænia. Instead of unfolding like the finger of a glove, the neck of the scolex first emerges in the

[1] February, 1887.

form of a loop. While in this position the head lies close beside the base of the neck in the vicinity of the contractile bulbs. The head is released by a simple straightening of the neck, which, at its base, a short distance back of the contractile bulbs, remains attached to the head part of the blastocyst. In this specimen, after the head of the scolex was released, the anterior part or head of the blastocyst continued for some time working backward and forward on the neck of the scolex like a movable barrel on a stationary piston. Considerable pressure was applied for the purpose of making the scolex separate entirely from the blastocyst, but without causing it to break loose. When pressed out as far as it would go, it could be seen that there was an unbroken continuity between the scolex and the blastocyst. The posterior tapering end of the scolex, however, was clothed with straight, fine, hair-like bristles like those noticed in an embryo *Rhynchobothrium*.

The bothria are four in number, in opposite, lateral pairs, spreading from the front of the head. They are quite mobile, sometimes with the sucking disks turned forward, sometimes backward, and with a retractile proboscis, armed with long, slender, slightly recurved hooks, belonging to each bothrium. The proboscides were everted but a short distance, but they were apparently fully developed. The proboscis sheaths are spiral and the contractile bulbs slender. A reticulated system of vessels in the margins of the bothria and sinuous longitudinal vessels behind the contractile bulbs and near the edges of the blastocyst were made out in the living specimen.

In a specimen which was lightly stained with carmine and placed in glycerine, the scolex and body part of the blastocyst are red, while the globular head-like part of the blastocyst is golden yellow, the staining fluid only showing faintly in some longitudinal central vessels. This same part in unstained specimens in alcohol is yellowish and more opaque than the body, which is white with a faint bluish tinge.

The development of this form at this period differs from that of *Rhynchobothrium*, in that the blastocyst is retained as a part of the scolex after the latter is released. I have repeatedly tried the experiment of opening blastocysts of these two types, with the results in every case the same. In the one case the embryo does not seem to have any permanent connection with the blastocyst when the walls of the latter are broken; in the other, the embryo can not be removed from the blastocyst without breaking a connecting bond. The finding of a specimen[1] in the intestine of a sting ray (*Trygon centrura*) proves that the blastocyst maintains its connection with the embryo for some time and through many vicissitudes. It is highly probable that it thus forms a part of the adult strobile, or at least remains attached as a nutritive vessel until absorbed by the growing strobile.

Following are brief excerpts from memoranda made on some of the

[1] United States Fish Commission Report, 1897, p. 861, pl. xv, fig. 2.

foregoing lots, either at time of collecting or in the subsequent examinations of them incident to the work of identification. These notes I shall arrange under the head of the several hosts:

1. *Pomatomus saltatrix.*—Cysts containing this parasite are of frequent occurrence in this host. They usually occur in elongated cysts lying on the viscera, in the mesentery, sometimes embedded in the liver. I find among my notes mention of one which had the exceptional position of being under the submucous coat of the stomach. The length of this blastocyst was 25 mm. It was rolled up irregularly into a round mass.

Usually these cysts can be readily recognized from those containing Rhynchobothrium larva by their more slender habit, and, where the outline of the contained blastocyst can be distinguished, by the neck-like constriction near one end which separates the subglobose head portion, in which the embryo lies, from the elongated body of the blastocyst. The blastocyst is sometimes very long and does not seem to bear any special relation to the size of the embryo, which, when fully developed, does not exhibit much variation in size. The longest cyst from the bluefish of which I have made measurements is 55 mm.; anterior part, 3 in diameter, elongating to 6; posterior part, 1.1 in diameter. After twenty-four hours in water one of these blastocysts measured 92 mm. in length. In one lot of cysts examined in alcohol, among the usual elongated forms was one oval cyst, which contained a dark brown mass of waxy consistency, in which a blastocyst of a *synbothrium* was found. The posterior part of the blastocyst, instead of being elongated, was contracted to 5 mm. in length, and was 2.25 mm. in breadth.

2. *Cynoscion regalis.*—I have not found this parasite of frequent occurrence in the squeteague. When they do occur, they have the same appearance as those of the bluefish. Dimensions of alcoholic specimen: Length of blastocyst, 27 mm.; length of anterior portion, 6; diameter of anterior portion, 2.5; diameter of elongated posterior portion, 2; length of embryo, approximate, 4.6; breadth of head (compressed), 0.48; diameter of neck, 0.17; length of contractile bulbs, 1.4; length of slender hooks on proboscis, 0.06 to 0.08. Color of head portion yellowish brown, elsewhere whitish.

3. *Scomberomorus cavalla, S. regalis, S. maculatus.*—This parasite appears to be of frequent occurrence in these fish. I have not had the opportunity of examining many of these fish, but all that I have examined have had a number of these parasites in elongated cysts on the viscera. One specimen from *S. maculatus* was found with a mass of carbonate of lime in the posterior part of the blastocyst.

4. *Pomolobus mediocris.*—A blastocyst, with everted embryo attached, from the peritoneum of this fish, was very active when first removed from the yellowish-white cyst, varying in length within short intervals from 9 to 20 mm. The globular anterior portion from which the head

and neck of the embryo were released was the most changeable, its walls being well supplied with contractile tissue.

Dimensions of alcoholic specimen: Length of posterior elongated portion, 7.1 mm.; diameter of same, 0.9; diameter of globular anterior portion, 1.5; breadth of head of embryo, 0.47; diameter of neck, 0.2; length of longest hooks, 0.08; length of small hooks, 0.013.

5. *Paralichthys dentatus.*—The single specimen which I have from this host presents some differences from those from other hosts and may differ from them specifically. A sketch was made of the living specimen, but no other notes made at time of collecting. The sketch shows the usual division of the elongated blastocyst into an anterior subglobular portion containing the embryo and an elongated posterior portion—the latter about three and a half times the length of the former when at rest. When compressed, there is brought into view an interior prolongation of the posterior part, which extends into the anterior portion, occupying about the posterior fourth of that part, while the embryo is confined to the anterior fourth of the same part. Two prominent sinuous vessels are seen in the anterior part lying one on each of the lateral margins—when compressed (fig. 8). Unfortunately the alcohol had evaporated from this specimen when I came to study it for identification, and it was in very poor condition. The hooks were dark red. This I think must be due to changes with the drying of the specimen, since I find no mention of such fact among my notes. If the hooks had been red in the living worm, that fact would hardly have been overlooked, although but superficial examination was made of it at that time. The breadth of the head, alcoholic, is 0.46 m.; diameter of neck, 0.12. The largest hooks are not well shown; length of such hooks as were seen, near base of proboscis, 0.038. This is much less than length of characteristic long slender hooks in this species, but not contradictory of that species, since some hooks near base of proboscis in typical specimens may be found having such dimensions as this.

6. *Trygon centrura.*—Found on three occasions in this host, where its presence must be regarded as accidental (*Xenosite*, van Beneden). One examined as alcoholic specimen; proboscides fully extended and exhibiting characteristic hooks; at base hooks resemble those figured in my paper in the United States Fish Commission report for 1887; elsewhere hooks long and slender, about 0.06 mm. in length; standing nearly at right angles to the proboscis, and having the appearance of being in whorls instead of spirals, with about ten hooks in a whorl.

The cysts from one sting ray were hard, with a yellowish-white granular deposit, appearing to be undergoing degeneration, but with larvæ developed in them.

7. *Mustelus canis.*—Found at two different times in this host. Specimens identical with those found in sting ray, large hooks slightly bifurcate; this character also seen in hooks of specimens from other hosts. Measurements of living specimen: Length of cyst, 5 mm.; diameter, 3;

length of blastocyst, about 20; breadth of head of embryo, 0.72; diameter of neck, 0.2; length of bulbs, 0.9; length of hooks, 0.06. The anterior portion of blastocyst was oval, with about three constrictions posteriorly, giving it a somewhat chrysalis outline. The length of the head and neck of embryo in one instance, 4.5 mm.; in another, 5.2.

Hill[1] has examined some of the developmental stages of a Synbothrium agreeing closely with published descriptions of *S. fillicolle*, which he finds in the peritoneum surrounding the intestine of the jewfish (*Sciæna aquila*).

The following conclusions are reached by that author:

1. The so-called blastocyst or endocyst is the serial homologue of the caudal vesicle of the Cysticerci.

2. The wall of the invagination sac represents the body of these forms.

3. The scolex, consisting of head and neck, arises from the bottom of the invagination sac, as a knob-shaped process, which, by subsequent elongation and differentiation, gives rise to the fully formed scolex.

EXPLANATION OF PLATES.

Many of the figures were drawn with the aid of an Abbe camera lucida, mounted on a Zeiss stand No. VII.

Where not expressly stated otherwise, it is to be understood that the sketches are made from alcoholic specimens.

Plate V, figs. 8–11, were drawn by Mrs. M. B. Linton, other figures by the author.

PLATE I.

Ligula chilomycteri, from spleen of *Chilomycterus geometricus*.

1. Anterior end of specimen. Enlarged three times.

Larval dibothrium (?) from cyst in *Sarda sarda*.

2. Entire specimen. Enlarged eighteen times.

3. Posterior end of same, cleared in oil of cloves, enlarged about fifty times.

Larval *Echeneibothria*. ?

4. Scolex of specimen from intestine of *Limanda ferruginea*. Enlarged two hundred and twenty-five times.

5. Specimen from intestine of *Lophius piscatorius*, showing pseudosegment, life. Enlarged twelve times.

6. Specimen with head retracted from gall bladder of *Cynoscion regalis*, life. Enlarged sixty times.

7. Specimen from same host, myzorhynchus funnel-shaped, life. Enlarged sixty times.

8. Specimen from gall bladder of *C. regalis*, *r* red spots, life. Enlarged thirty-six times.

9. Scolex from same host, head retracted, life.

10. Scolex from same host, myzorhynchus extended, life.

11. Abnormal specimen from gall bladder of *C. regalis*, life. Enlarged twelve times.

12. Specimen from gall bladder of *C. regalis*, compressed, life. Enlarged twenty-four times.

[1] Proceedings of the Linnean Society of New South Wales, IX, p. 75.

13. Anterior end of head of same, compressed, life. Enlarged two hundred and twenty-five times. *b b*, bothria; *p. myzorhynchus; v, v*, vessels of water vascular system; *c*, calcareous bodies.

14. Specimen from intestine of *Paralichthys dentatus*, contracted, life.

15. Abnormal specimen from same host; *a*, posterior end contracted, life.

PLATE II.

Phyllobothrium loliginis, from the squid (*Ommastrephes illecebrosus*)

1. Specimen slightly compressed and enlarged, life.

2. Sketch of specimen lying in water, life.

3. Scolex with one bothrium flattened on bottom of dish, life.

4. Scolex compressed and magnified. *p. myzorhynchus: b b*, bothria; *v*, vessel of water vascular system, life.

5. Single bothrium, enlarged, life.

6. Anterior end of bothrium, showing auxiliary suckers, life.

7. Very young scolex, magnified, life.

8. Another young scolex, showing different state of contraction, life.

9. Another young scolex with bothria retracted; *b*, posterior edge of bothrium, natural size.

Thysanocephalum, species from the squid (*Ommastrephes illecebrosus*).

10. Lateral view of scolex. Enlarged two hundred and twenty-five times.

11. Antero-marginal view of same. Enlarged two hundred and twenty-five times.

Rhynchobothrium larvæ.

12. Part of proboscis and hooks of specimen from cyst in *Centropristes striatus; a b*, hooks from opposite sides of proboscis near apex. Enlarged three hundred times.

13. Cyst (*c*) with blastocyst (*b*) and embryo (*e*) from *Caranx chrysus*. Enlarged eighteen times.

14. Embryo of same released from blastocyst and enlarged.

15. Portion of proboscis of same, highly magnified.

16. Cyst (*c*), blastocyst (*b*), and embryo (*e*) from *Anguilla chrysypa; m*, hyaline membrane surrounding the blastocyst. Enlarged fifteen times.

PLATE III.

Rhynchobothrium larvæ.

1. Embryo removed from cyst, peritoneum of *Anguilla chrysypa*. Enlarged fifteen times, life.

2. Cyst, blastocyst, and embryo from *Microgadus tomcod*. Enlarged fifteen times, life.

3. Cyst, blastocyst, and embryo from *Prionotus evolans*. Enlarged twenty times, life.

4. Embryo removed from cyst (fig. 3). Enlarged twenty-four times, life.

5. Ten hooks from proboscis of embryo (fig. 4). Enlarged three hundred and seventy-five times.

6. Hooks, base of proboscis of embryo from cyst in *Menticirrus saxatilis*. Enlarged two hundred times.

7. Hooks, base of retracted proboscis of embryo from cyst in *Macrurus bairdii*. Enlarged two hundred times.

8. *a* to *f*, hooks, proboscis of embryo from cyst in *Phycis chuss*. Enlarged three hundred times.

9. Two hooks from proboscis of embryo from cyst in *Stenotomus chrysops*. Enlarged about three hundred times.

10. Cyst with blastocyst and embryo from *Stenotomus chrysops*. Enlarged twenty-two times, life.

11. Embryo removed from cyst (fig. 10). Enlarged, life.

12. *a* and *b*, parts of proboscis of same (fig. 11), showing retractor muscles (*r m*) and granular ribbon (*g*) through the transparent walls. Enlarged two hundred and twenty-five times, life.

13. Optical section of contractile bulb of embryo shown in fig. 11, showing insertion (*m*) of retractor muscle of proboscis, life.

14. *Rhynchobothrium* from intestine of *Carcharias littoralis*. Enlarged ten times.

15. Part of body of same showing racemose bodies. Enlarged two hundred and twenty-five times.

16. Hooks from retracted proboscis of same, large hook near base, small hook near middle or toward apex of proboscis. Enlarged three hundred times.

17. Embryo from cyst in *Pomatomus saltatrix*. Enlarged three times.

18. Lateral view of head of same. Enlarged twenty-seven times.

19. Hooks from retracted proboscis of same. Enlarged three hundred times.

PLATE IV.

Rhynchobothrium larvæ.

1. Cyst with blastocyst and embryo from *Cynoscion regalis*. Enlarged eighteen times, life.

2. Blastocyst from *Mustelus canis*. Enlarged three times.

Rhynchobothrium heterospine, Linton, from *Anguilla chrysypa*.

3. Blastocyst (*b*) inclosed in a hyaline envelope (*h*) and containing an embryo (*e*). Enlarged, life.

4. Embryo removed from blastocyst (fig. 3). Enlarged twenty-two times, life.

5. Contractile bulb and beginning of proboscis sheath, diagrammatic representation of diagonal muscles, life. From embryo (fig. 4).

6. Optical section of same: *a*, proboscis sheath; *b*, wall of bulb; *c*, central cavity filled with fluid which is forced out into the proboscis sheath by the contraction of the muscular walls of the bulb, thus causing the proboscis to unroll; *d*, retractor muscle inserted on the wall of the bulb and attached to the tip of the proboscis. The contraction of the longitudinal fibers of this muscle retracts the proboscis, life.

7. Anterior end of bulb, optical section, more enlarged, letters same as in fig. 6.

8. Hooks from proboscis of embryo (fig. 4). Enlarged three hundred times.

Rhynchobothrium imparispine, Linton, from *Lophius piscatorius*.

9. Cyst. Enlarged about three times, life.

10. Blastocyst from same, compressed to show embryo. Enlarged nine times, life.

11. Embryo with blastocyst attached as nutrient vessel. Enlarged six times, life.

12. Hooks from proboscis of same. Enlarged three hundred and forty times.

Rhynchobothrium speciosum, new species.

13. Embryo removed from cyst, peritoneum of *Pomatomus saltatrix*. Enlarged three times. *a*, bothrium. Enlarged six times.

14. Optical section of neck of living specimen from *P. saltatrix*. Enlarged eighteen times. *c*, cuticle; *gl.*, granulo-fibrous layer; *vl.*, vascular layer; *lm.*, longitudinal muscles; *Pm.*, parenchyma; *sh.*, proboscis sheath; *rm.*, retractor muscles of proboscides; *Pr.*, retracted proboscis.

PLATE V.

Rhynchobothrium speciosum, new species.

1. View of portion of proboscis near base. Specimen from *P. saltatrix*. Enlarged two hundred and twenty-five times.
2. Obverse side of proboscis from that shown in fig. 1, near apex.
3. Apex of proboscis partly retracted, optical section diagrammatic. Specimen from *P. saltatrix*.
4. Part of proboscis of embryo removed from cyst in *Tylosurus caribbæus*. Enlarged two hundred and twenty-five times.
5. Obverse side of proboscis shown in fig. 4.
6. Group of hooks seen through walls of sheath, proboscides retracted; specimen from cyst in *Cynoscion regalis*. Enlarged two hundred and twenty-five times.
7. Plexus of vessels of water vascular system in edge of bothrium. Specimen from *P. saltatrix*. Enlarged one hundred and fifty times, life.

Rhynchobothrium attenuatum, Rudolphi, from *Xiphias gladius*.

8. Sketch of living specimen in water. Enlarged three times.
9. Diagram of front view of head, showing bothria and arrangement of proboscides.
10. Diagram of proboscis, sheath, contractile bulb, and retractor muscle.
11. View of proboscis. Enlarged twenty-seven times, life.

PLATE VI.

Otobothrium dipsacum, new species, from *Pomatomus saltatrix*.

1. Embryo removed from blastocyst. *a*, ciliated organs of bothria (shown enlarged in figs. 4, 5). Enlarged twenty-seven times.
2. Two transverse rows of hooks on proboscis. Enlarged three hundred times.
3. Obverse side of proboscis from that shown in fig. 2.
4. Ciliated organs (rudimentary sense organs?) of bothria. Enlarged two hundred and twenty-five times.
5. The same invaginated.

Tetrarhynchus larvæ.

6. Optical section of cyst with blastocyst and embryo from *Mustelus canis*. Enlarged eighteen times, life.
7. Portion of proboscis of larva from stomach wall of *M. canis*. Enlarged three hundred times.
8. Cyst with embryo from *Chætodipterus faber*. Magnified.
9. Portion of proboscis from embryo of same. Enlarged three hundred times.
10. Cyst and blastocyst from peritoneum of *Stromateus triacanthus*. Enlarged twenty-two times, life.

Tetrarhynchus bisulcatum, Linton.

11. Cyst, blastocyst, and embryo from *Paralichthys dentatus*. Enlarged fifty times.
12. Scolex from cyst in stomach wall of *Cynoscion regalis*. Enlarged thirty-two times.
13. Portion of proboscis of specimen from *C. regalis*. *a*, hooks from opposite sides of proboscis. Enlarged three hundred times.
14. Base of proboscis of scolex from pylorus of *Tetramarce occidentalis*. Enlarged three hundred times.
15. Posterior end of scolex of same. Enlarged fifty times.

PLATE VII.

Tetrarhynchus crinaceus, Beneden.

1. Embryo attached to blastocyst, from peritoneum of *Cynoscion regalis*. Enlarged three times.
2. Head and neck of same. Enlarged fifteen times.
3. Portion of proboscis of same, apex. Enlarged two hundred times.
4. Portion of proboscis of same. Enlarged four hundred times.
5. Hooks, specimen from *C. regalis*, proboscides retracted. Enlarged two hundred and twenty-five times.
6. Head and neck of specimen from cyst in *Pomatomus saltatrix*. Enlarged fifty times.
7. Portion of proboscis of same. Enlarged two hundred and twenty-five times.
8. *a* and *b*, hooks on opposite sides of proboscis of same, drawn to same scale. Enlarged fifty times.

Tetrarhynchus elongatus, Wagener.

9. Part of a blastocyst from liver of *Mola rotunda*. Enlarged one and one-half times.
10. Scolex liberated from inclosing walls of blastocyst, but with slender portion of blastocyst still attached.
11. Scolex showing prolonged anterior ends of the bothria, making hookless bases to the proboscides. Enlarged six times.
12. *a* to *g*, hooks seen through walls of the proboscis-sheaths. Enlarged two hundred and twenty-five times.

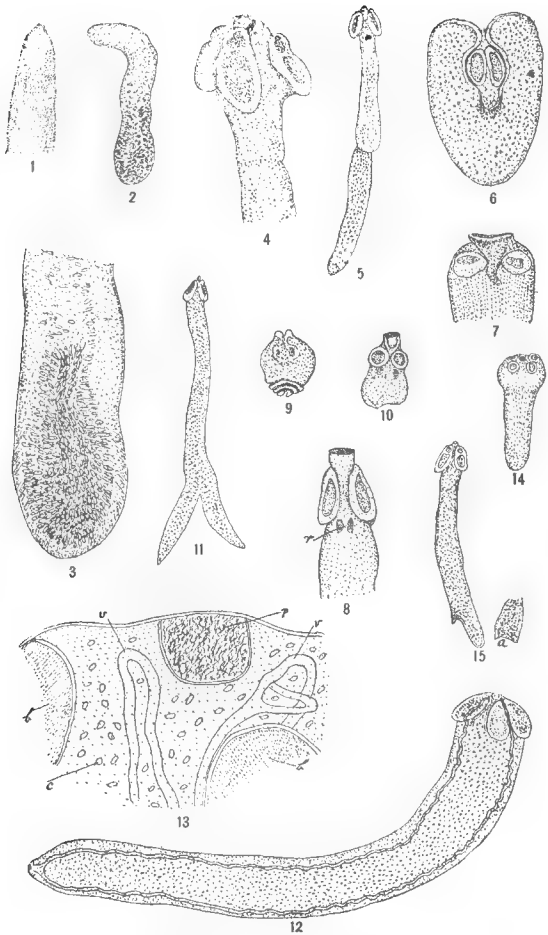
PLATE VIII.

Tetrarhynchus bicolor, Bartels.

1. Scolex from *Xiphias gladius*. Enlarged three times.
2. Scolex from *Coryphæna hippurus*. Enlarged six times.
3. Scolex from *Galeocerdo tigrinus*. Enlarged six times.
4. Proboscis toward apex of specimen, shown in fig. 3. Enlarged two hundred and twenty-five times.
5. View of base of proboscis of specimen from *Carcharinus obscurus*. Enlarged three hundred times.
6. Same specimen view of proboscis near apex. Enlarged three hundred times.

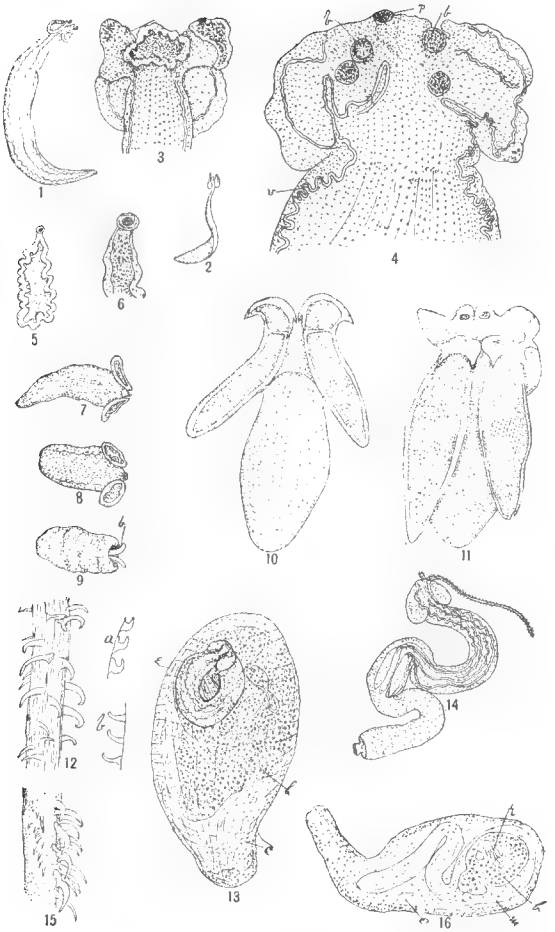
Synbothrium filicolle, Linton.

7. Blastocyst from *Cynoscion regalis*. Enlarged one and one-half times.
8. Anterior end of blastocyst compressed, specimen from *Paralichthys dentatus*. Enlarged fifteen times, life. Inked from pencil sketch by Margaret B. Linton.
9. Portion of proboscis, specimen from *Mustelus canis*. Enlarged three hundred times.
10. Portion of proboscis toward apex, specimen from *Trygon centrura*. Enlarged three hundred times.
11. Hooks from proboscis of specimen from *Cynoscion regalis*. Enlarged three hundred times.
12. Hooks from proboscis of specimen from *Pomatomus saltatrix*—*a* near base, *b* middle, *c* toward apex. Enlarged three hundred times.



LIGULA AND LARVAL ECHENEIBOTHRIA.

FOR EXPLANATION OF PLATE SEE PAGES 820, 821.

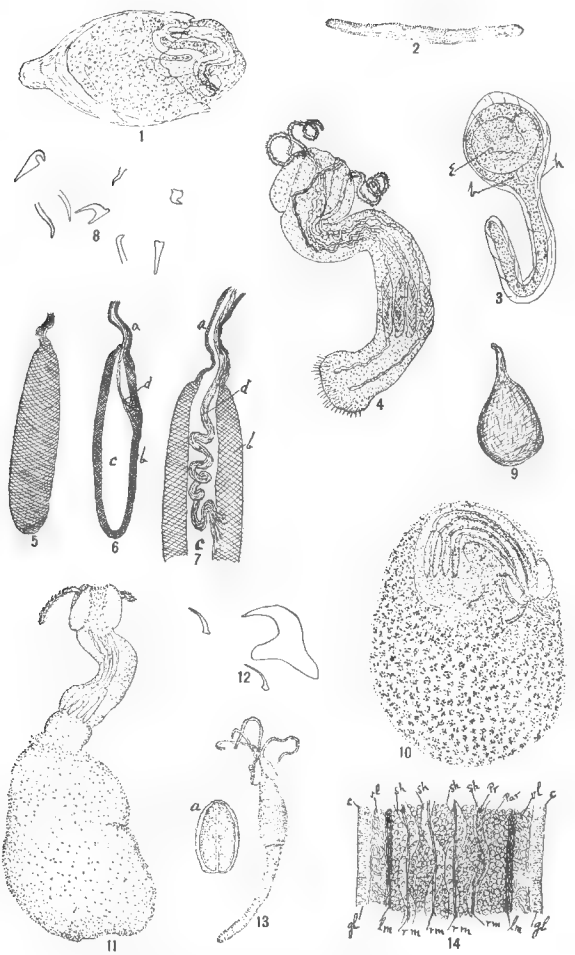


PHYLLOBOTHRIUM, THYSANOCEPHALUM, AND RHYNCHOBOTHRIUM LARVÆ.

FOR EXPLANATION OF PLATE SEE PAGE 821.

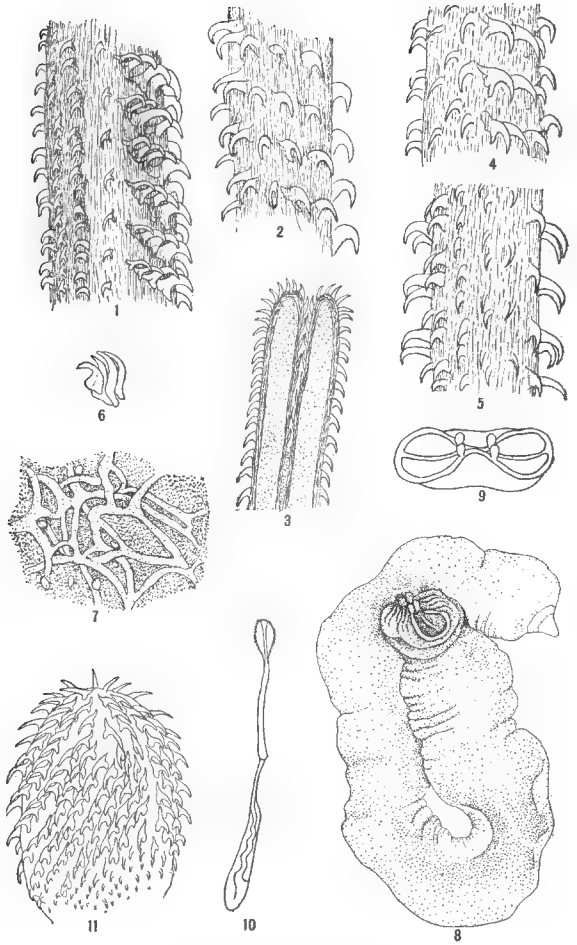
RHYNCHOBOTHRIUM LARVÆ.

FOR EXPLANATION OF PLATE SEE PAGES 821, 822.



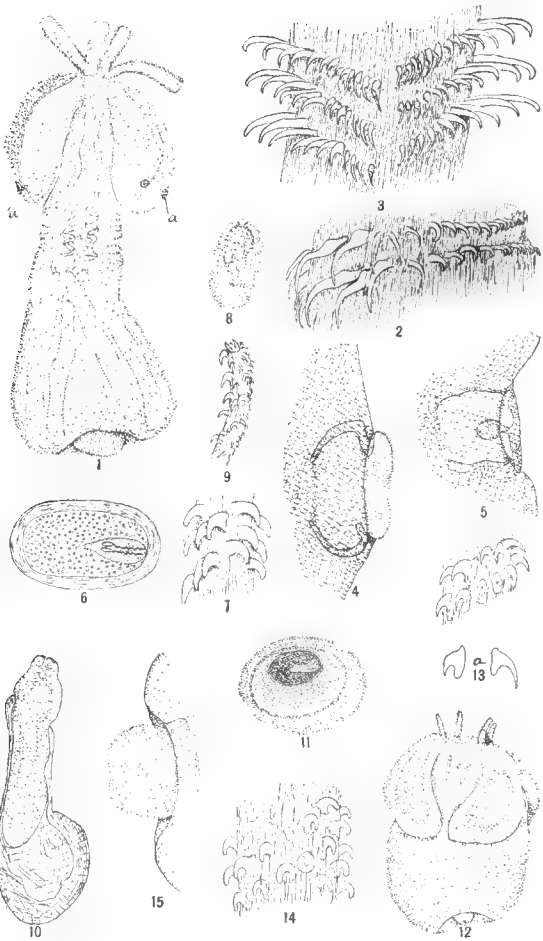
RHYNCHOBOTHRIUM LARVÆ, RHYNCHOBOTHRIUM HETEROSPINE, RHYNCHOBOTHRIUM IMPARISPINE, AND RHYNCHOBOTHRIUM SPECIOSUM.

FOR EXPLANATION OF PLATE SEE PAGE 822.



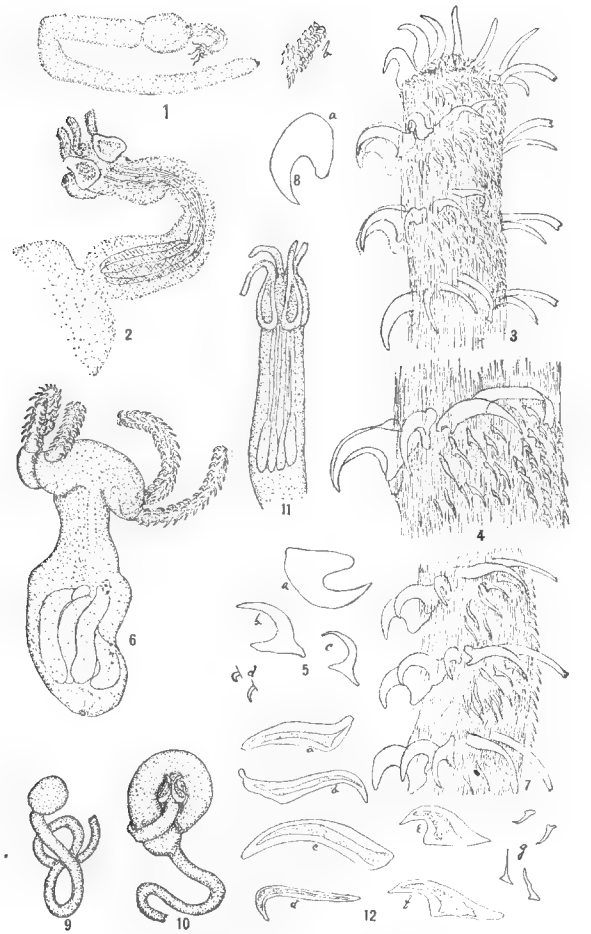
RHYNCHOBOTHRIUM SPECIOSUM AND RHYNCHOBOTHRIUM ATTENUATUM.

FOR EXPLANATION OF PLATE SEE PAGE 823.



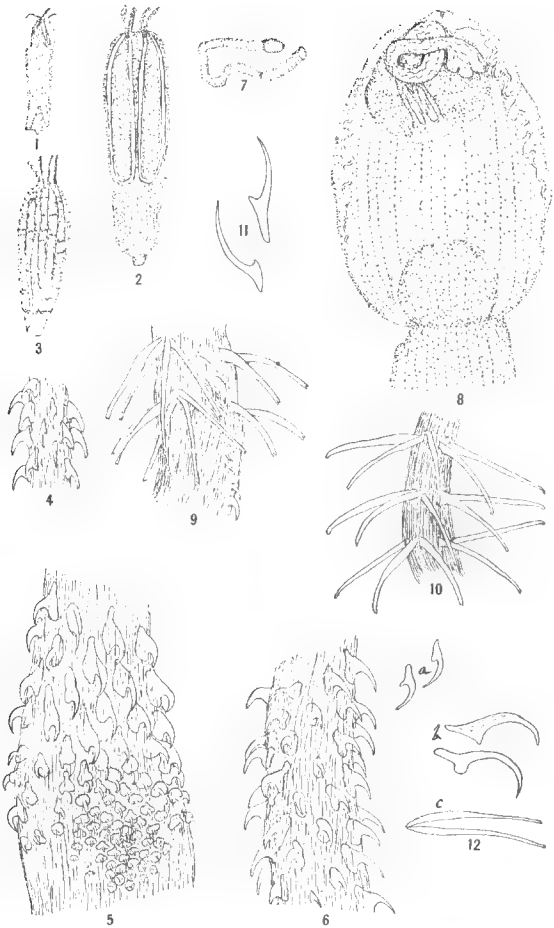
OTOBOTHRIUM DIPSACUM, TETRARHYNCHUS LARVÆ, AND TETRARHYNCHUS BISULCATUM.

FOR EXPLANATION OF PLATE SEE PAGE 823.



TETRARHYNCHUS ERINACEUS AND TETRARHYNCHUS ELONGATUS.

FOR EXPLANATION OF PLATE SEE PAGE 824.



TETRARHYNCHUS BICOLOR AND SYNBOTHRIUM FILICOLLE.

FOR EXPLANATION OF PLATE SEE PAGE 824.

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the paper "Notes on Larval Cestode Parasites of Fishe
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